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NAT'L INST OF STANDARDS & TECH R.I.C.



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*NIST Special Publication 305
Supplement 20*

***Publications of the
National Institute
of Standards and
Technology
1988 Catalog***

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NIST **United States Department of Commerce**
National Institute of Standards and Technology

NATIONAL INSTITUTE OF STANDARDS & TECHNOLOGY

Research Information Center
Gaithersburg, MD 20899



The National Institute of Standards and Technology¹ was established by an act of Congress on March 3, 1901. The Institute's overall goal is to strengthen and advance the Nation's science and technology and facilitate their effective application for public benefit. To this end, the Institute conducts research to assure international competitiveness and leadership of U.S. Industry, science and technology. NIST work involves development and transfer of measurements, standards and related science and technology, in support of continually improving U.S. productivity, product quality and reliability, innovation and underlying science and engineering. The Institute's technical work is performed by the National Measurement Laboratory, the National Engineering Laboratory, the National Computer Systems Laboratory, and the Institute for Materials Science and Engineering.

The National Measurement Laboratory

Provides the national system of physical and chemical measurement; coordinates the system with measurement systems of other nations and furnishes essential services leading to accurate and uniform physical and chemical measurement throughout the Nation's scientific community, industry, and commerce; provides advisory and research services to other Government agencies; conducts physical and chemical research; develops, produces, and distributes Standard Reference Materials; provides calibration services; and manages the National Standard Reference Data System. The Laboratory consists of the following centers:

- Basic Standards²
- Radiation Research
- Chemical Physics
- Analytical Chemistry

The National Engineering Laboratory

Provides technology and technical services to the public and private sectors to address national needs and to solve national problems; conducts research in engineering and applied science in support of these efforts; builds and maintains competence in the necessary disciplines required to carry out this research and technical service; develops engineering data and measurement capabilities; provides engineering measurement traceability services; develops test methods and proposes engineering standards and code changes; develops and proposes new engineering practices; and develops and improves mechanisms to transfer results of its research to the ultimate user. The Laboratory consists of the following centers:

- Computing and Applied Mathematics
- Electronics and Electrical Engineering²
- Manufacturing Engineering
- Building Technology
- Fire Research
- Chemical Engineering³

The National Computer Systems Laboratory

Conducts research and provides scientific and technical services to aid Federal agencies in the selection, acquisition, application, and use of computer technology to improve effectiveness and economy in Government operations in accordance with Public Law 89-306 (40 U.S.C. 759), relevant Executive Orders, and other directives; carries out this mission by managing the Federal Information Processing Standards Program, developing Federal ADP standards guidelines, and managing Federal participation in ADP voluntary standardization activities; provides scientific and technological advisory services and assistance to Federal agencies; and provides the technical foundation for computer-related policies of the Federal Government. The Laboratory consists of the following divisions:

- Information Systems Engineering
- Systems and Software Technology
- Computer Security
- Systems and Network Architecture
- Advanced Systems

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Conducts research and provides measurements, data, standards, reference materials, quantitative understanding and other technical information fundamental to the processing, structure, properties and performance of materials; addresses the scientific basis for new advanced materials technologies; plans research around cross-cutting scientific themes such as nondestructive evaluation and phase diagram development; oversees Institute-wide technical programs in nuclear reactor radiation research and nondestructive evaluation; and broadly disseminates generic technical information resulting from its programs. The Institute consists of the following divisions:

- Ceramics
- Fracture and Deformation³
- Polymers
- Metallurgy
- Reactor Radiation

¹Headquarters and Laboratories at Gaithersburg, MD, unless otherwise noted; mailing address Gaithersburg, MD 20899.

²Some divisions within the center are located at Boulder, CO 80303.

³Located at Boulder, CO, with some elements at Gaithersburg, MD.

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Supplement 20

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Rebecca J. Pardee, Editor

*Information Resources and Services Division
National Institute of Standards and Technology
Gaithersburg, MD 20899*

Issued June 1989



**U.S. Department of Commerce
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CATALOG STRUCTURE AND USE

Full bibliographic citations including keywords and abstracts for National Institute of Standards and Technology (NIST) (formerly National Bureau of Standards (NBS)) papers published and entered into the National Technical Information Service (NTIS) collection are cited in the "NIST Publications Announcements" section of this catalog. (Also included are papers published prior to 1988 but not reported in previous supplements of this annual catalog.) Entries are arranged by NTIS subject classifications which consist of 38 broad subject categories (see back cover) and over 350 subcategories. Within a subcategory, entries are listed alphanumerically by NTIS order number.

Four indexes are included to allow the user to identify papers by personal author, keywords, title, and NTIS order/report number. Each entry lists the appropriate title, the NTIS order number, and the abstract number.

Papers may also be identified by searching the NTIS database either online via commercially available systems such as DIALOG, or in the issues of NTIS's *Government Reports Announcements and Index* and its *Government Reports Annual Index*.

AVAILABILITY AND ORDERING INFORMATION

The highest quality and least expensive copies of NIST publications published as Government documents are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Publications cited with stock numbers (SN) should be ordered by these numbers. GPO will accept payment by check, money order, VISA, MasterCard, or deposit account. For availability and price, write to the GPO or telephone (202) 783-3238. Should an NIST publication be out of print at the GPO, its continued availability is assured at NTIS which sells publications in microfiche or paper copy reproduced from microfiche.

If an entry has a price code, such as PC A04/MF A01, the publication may be ordered from NTIS in paper copy (PC) or microfiche (MF) or both if both codes are given. Order from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. A copy of the latest price code schedule is available from NTIS. NTIS will accept payment by check, money order, VISA, American Express, MasterCard, or deposit account. NTIS is the sole source of Federal Information Processing Standards (FIPS), Interagency Reports (IRs), and Grant/Contract Reports (GCRs). For more information call (703) 487-4650.

Papers noted "Not Available NTIS" may be obtained directly from the author or from the external publisher

cited. Such papers are not for sale by either the GPO or NTIS.

Two other sources for NIST publications are depository libraries (libraries designated to receive Government publications) and Department of Commerce District Offices. The depository libraries listed in Appendix A receive selected NIST publications (see inside back cover for a description of the various NIST publication series). While not every Government publication is sent to all depository libraries, certain depositories designated as Regional Depositories receive and retain one copy of all Government publications made available. Contact the depository library in your area to obtain information on what is available and where.

Department of Commerce District Offices listed in Appendix B provide ready access at the local level to publications, statistical data and summaries, and surveys. Each District Office serves as an official sales agency of the Superintendent of Documents, U.S. Government Printing Office. A wide range of Government publications can be purchased from these offices. In addition, the reference library of each District Office contains review copies of many Government publications.

NIST PUBLICATIONS ANNOUNCEMENTS

SAMPLE ENTRY

MANUFACTURING TECHNOLOGY

NTIS Subject Category

Robotics/Robots

800,904

PB89-133540

PC A03/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Intelligent Controls Group.

Manipulator Servo Level Task Decomposition.

J. C. Fiala. Oct 88, 40p

NIST/TN-1255

Contract F-000000

Keywords: *Servomechanisms, *Automatic control equipment, *Manipulators, Robots . . .

The document details the functionality of the Servo task decomposition modules for electric motor-powered manipulators with serial joints and unbranched kinematics.

NTIS Subcategory

Abstract Number

NTIS order number

Availability

Price Codes

Corporate or performing organization

Report Title

Personal authors

Report date

Page count

Report Number

Contract or grant number

Keywords: * Indicates keyword index entry

Abstract

ADMINISTRATION & MANAGEMENT

Management Information Systems

800,001

PB88-201561

PC A03/MF A01

National Bureau of Standards (ICST), Gaithersburg, MD. Information Systems Engineering Div.

Computer Science and Technology: Guide to Distributed Database Management.

Special pub. (Final).

E. N. Fong, and B. K. Rosen. Apr 88, 36p NBS-SP-500/154

Also available from Supt. of Docs. See also PB84-162189. Library of Congress catalog card no. 88-600516.

Keywords: *Information systems, *Management information systems, Data processing, Environments, Or-

ganizations, Planning, Strategies, Management, Decision making, Guidelines, *Data base management systems, *Distributed computer systems.

Distributed Database Management Systems are exciting and potentially very powerful. However, distributed database management systems often have created increased complexity of database management and controls without providing the expected benefit to the organization's operations. Distributed database management systems may not be desirable for every organization. Their benefits can be realized only with careful planning, and evaluation of alternative strategies. The guide provides an organization's decision makers the appropriate information to make good decisions in evaluating distributed database management technology for their individual environments. Also, the guide aids in planning for an orderly migration path into a distributed database environment.

800,002

PB89-113559

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Mfg. Engineering.

Information Resource Dictionary System: An Integration Mechanism for Product Data Exchange Specification.

H. Bloom, C. Furlani, M. Mitchell, J. Tyler, and D. Jefferson. Oct 88, 19p NISTIR-88/3862

See also PB88-139100.

Keywords: Information systems, Organizations, Standards, Specifications, Manufacturing, Models, *Information management, *Data dictionaries, *Software tools, Computer-aided manufacturing, Computer-aided design, Product Data Exchange Specification, PDES, Information Resource System, IRDS, CAD, Integration.

With sophisticated and ever evolving technologies, users are faced with the need to exchange information across diverse and dissimilar systems. At the same time the users must maintain the various contexts within their organization and functional responsibility. The integration of systems as well as the integration of information within the technological heterogeneity is the 'core' of product data exchange specification. The need to organize the integration and exchange of the information has been recognized. A way to store and manage all the components of PDES development in one logical, standard, dictionary system is the cornerstone for automation and reusability in the future. The complexity of the integration task, the validation process, the numerous topical and application models, and the necessary documentation, require the use of a dictionary tool to manage and track the model integration stage of the PDES life cycle. The Information Resource Dictionary System (IRDS) standard being developed by ANSI and NIST can meet the need. The IRDS can be used to identify and control all of the 'pieces' that make up PDES and to evaluate the effect

ADMINISTRATION & MANAGEMENT

Management Information Systems

of needed changes that will occur as the PDES standard emerges.

Management Practice

800,003

PB89-129522

PC A05/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Applied Economics Group.

Techniques for Treating Uncertainty and Risk in the Economic Evaluation of Building Investments. Special pub. (Final).

H. E. Marshall. Sep 88, 99p NIST/SP-757

Also available from Supt. of Docs. See also PB84-217058. Library of Congress catalog card no. 88-600584.

Keywords: *Benefit cost analysis, *Buildings, Return on investment, Economic analysis, Cost effectiveness, Probability theory, Risk, Life cycle costs.

Four economic methods—life-cycle costing, net benefits, benefit-cost ratio, and adjusted internal rate of return—are illustrated in a building investment problem. Input values are first assumed to be certain; thus uncertainty and risk are ignored in arriving at measures of project worth. Then the same four methods are examined with techniques for treating uncertainty in input values and for measuring risk exposure (i.e., the probability of failing to achieve predicted investment worth). Risk attitude, the willingness of a decision maker to take a chance or gamble on an investment of uncertain outcome, is also incorporated. Techniques examined include conservative cash flow estimation, sensitivity analysis, etc. Advantages and disadvantages of each technique are described. The techniques are applicable to any capital budget expenditure whose future stream of benefits, revenues, savings, or costs is uncertain. Guidance is provided for selecting the appropriate technique for any given investment problem.

Productivity

800,004

PB88-164157

PC A04/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.

Office Design Measurements for Productivity: A Research Overview.

A. I. Rubin. Dec 87, 74p NBSIR-87/3688

Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Productivity, *Office buildings, *Design criteria, Human factors engineering, Office automation.

The Public Building Service of the General Services Administration sponsored the present investigation to: Determine the effects of building design, and 'high quality design' in particular, on productivity/Determine the state of the art of productivity measurement, applicable to the study of office tasks/Identify the various factors that influence productivity to better determine those which can be attributed to design issues. The study is primarily based on a comprehensive literature search of 15 data bases, supplemented by personal contacts with specialists on the topic. The report reviews and distills the major findings of more than 550 publications.

800,005

PB88-228291

Not available NTIS

National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.

Measuring Microcomputer Productivity.

Final rept.,

W. M. Osborne, and L. Rosenthal. 1988, 18p

Pub. in Computer Programming Management, p1-18 1988.

Keywords: *Microcomputers, *Productivity, *Data processing equipment, *Management information systems, Measurement, Quantitative analysis, Reprints, *Office automation, National Bureau of Standards.

Although it is generally assumed that the use of microcomputers helps improve productivity in an office envi-

ronment, quantitative measures in this area are lacking. The article addresses the measurement of the effect of microcomputer-based technology on productivity in an end-user office environment. It identifies and assesses the various techniques and measures used to describe the magnitude of productivity improvements that result from the use of microcomputers in the workplace and recommends ways in which changes in productivity may be measured.

800,006

PB89-107684

PC A05/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.

Evaluation of the Working Environment at Selected U.S. Army Field Stations: Suggestions for Improvement.

A. I. Rubin, and B. L. Collins. Aug 88, 96p NBSIR-88/3827

Sponsored by Army Intelligence and Security Command, Arlington Hall Station, VA.

Keywords: *Environmental surveys, *Military facilities, Job satisfaction, Graphs(Charts), Army, Human factors engineering, Job analysis, Performance evaluation.

In response to concerns expressed by headquarters INSCOM, a detailed evaluation of environmental conditions in U.S. Army field stations was undertaken. In the present report, findings and recommendations are given based on interviews with station personnel questionnaire responses from over 600 people in three job types (operator, analyst, and administrative/other), extensive measurements of physical conditions, and careful observations of a host of representative activities. Three field stations were evaluated: Kunia, Augsburg, and Berlin. The findings confirm the concerns expressed by headquarters INSCOM; namely, field station personnel perform their jobs under conditions likely to impair their effectiveness. These include poor thermal, lighting, and acoustic conditions, as well as furnishings such as chairs and desks in very poor repair, equipment that is dysfunctional, and general lack of regular maintenance in the facilities. Suggestions for improving conditions in the facilities are presented.

Public Administration & Government

800,007

PB88-201512

PC A11/MF A01

National Bureau of Standards, Gaithersburg, MD. Associate Director of Industry and Standards.

Directory of Federal Government Certification Programs (for Products and Services).

Special pub. (Final).

M. Breitenberg. Apr 88, 234p NBS/SP-739

Also available from Supt. of Docs. Supersedes report dated Apr 86, PB86-191871. Library of Congress catalog card, no. 88-600511.

Keywords: *Directories, Regulations, Standards, Grading, Inspection, Specifications, *Certification, Data bases, Approved products, *Federal Government Certification.

The directory, which represents a joint effort of the U.S. Department of Agriculture (USDA) and the National Bureau of Standards (NBS), is designed to provide updated information on federal certification programs for products and services. This directory is a revision of NBS SP 714, Federal Government Certification Programs for Products and Services, edited by Robert B. Toth and published in April 1986. The directory is part of ongoing NBS/USDA efforts to establish and maintain comprehensive databases on standards, regulations, certification programs and related information in accordance with the requirements of the Trade Agreements Act of 1979. The material has been compiled to meet the needs of government, industry, and the public for information on U.S. Government certification programs.

AERONAUTICS & AERODYNAMICS

Avionics

800,008

PB88-164520

PC A04/MF A01

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Time-Domain System for Identification of the Natural Resonant Frequencies of Aircraft Relevant to Electromagnetic Compatibility Testing.

J. W. Adams, A. R. Ondrejka, and H. W. Medley. Nov 87, 54p NBSIR-87/3077

Sponsored by Army Aviation Systems Command, St. Louis, MO.

Keywords: *Helicopters, *Electromagnetic compatibility, *Resonant frequency, Aluminum alloys, Composite materials, Horn antennas, Prony algorithm.

A method of measuring the natural resonant frequencies of a structure is described. The measurement involves irradiating this structure, in the case a helicopter, with an impulsive electromagnetic (EM) field and receiving the echo reflected from the helicopter. Resonances are identified by using a mathematical algorithm based on Prony's method to operate on the digitized reflected signal. The measurement system consists of special TEM horns, pulse generators, a time-domain system, and Prony's algorithm. The frequency range covered is 5 megahertz to 250 megahertz; this range is determined by antenna and circuit characteristics. The measurement system is demonstrated, and measured data from several different helicopters are presented in different forms. These different forms are needed to determine which of the resonant frequencies are real and which are false. The false frequencies are byproducts of Prony's algorithm.

800,009

PB88-183975

PC A05/MF A01

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Aircraft Field Degradation and Electromagnetic Compatibility.

K. H. Cavcey, and D. S. Friday. Jan 88, 100p NBSIR-88/3083

Sponsored by Army Aviation Systems Command, St. Louis, MO.

Keywords: *Helicopters, *Electromagnetic compatibility, Electromagnetic interference, Degradation, Graphs(Charts), *Army aircraft.

The paper discusses the first tests undertaken to study the problem of field degradation in army aircraft (helicopters and one fixed wing airplane) due to the deterioration of electronic and electrical systems. The electromagnetic compatibility (EMC) of such systems was investigated by passive measurement of the aircraft as a collection of radio frequency sources. Methods for detection of these sources were developed that included sensitivity to both stationary and nonstationary noise that existed. The collected data were studied to see if there existed any obvious factors derived from the data that one could use to correct potential problems that might affect flight safety. Emphasis was placed upon making such test methods appropriate, inexpensive, and easily performed by army field personnel. In addition, applications to quality control or acceptance testing, as related to the Environmental Stress Screening (ESS) program, were examined.

AGRICULTURE & FOOD

Agronomy, Horticulture, & Plant Pathology

800,010

PB89-118939

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Structure of the Reaction Product of 4-hydroxy-2,3-dioxo-4-phenylbutanoic acid 1,4-lactone with o-phenylenediamine.

Final rept.,

B. Coxon, H. Dahn, H. S. El Khadem, and D. L.

Swartz. 1985, 10p

Pub. in Carbohydrate Research 142, n1 p1-10 1985.

Keywords: *Synthesis(Chemical), *Molecular structure, *Anilines, Lactones, Amines, Nuclear magnetic resonance, Mass spectroscopy, Reprints, *Butanoic acid lactone/hydroxy-dioxo-phenyl, Benzenediamine.

The structure of the reaction product of 4-phenyl-2,3-dioxobutyr-1,4-lactone with o-phenylene diamine has been investigated by ¹H, ¹³C, and ¹⁵N NMR spectroscopy and by mass spectrometry. Analysis of mass fragmentation patterns and NMR chemical shifts, coupling constants and nuclear Overhauser effects indicates that the reaction product has a benzylic alcohol, anilide structure. The mode of formation of the product has been delineated, and its relevance to the structures of similar products derived from D- and L-ascorbic acid is discussed.

Food Technology

800,011

PB88-175179

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Food Irradiation Dosimetry by Opti-Chromic Techniques.

Final rept.,

Z. J. Liu, B. B. Radak, and W. L. McLaughlin. 1985,

10p

Pub. in Radiation Physics and Chemistry 25, n1-3 p125-134 1985.

Keywords: *Food irradiation, Fibre optics, Dosimetry, Gamma radiation, Reprints, *Dose distributions.

In the disinfection and preservation of foods by ionizing radiation, dosimetry is a convenient and expeditious means of quality control. The routine dosimetry system for such applications must meet several requirements: (1) Suitable accuracy and reproducibility in large commercially available batches; (2) useful response in dose rate ranges of interest; (3) stability and ruggedness for on-line plan use under severe environmental conditions; (4) small size and ease of handling and readout for dose interpretation and dose distribution mapping; (5) long-term post-irradiation stability for archival date retrieval and inventory control. A new dosimetry system, namely the 'Opti-chromic' FWT-70 dosimeter (2), is tested here in order to evaluate its capability of fulfilling the above criteria. The dosimeter consists of a 5-cm long fluorinated polymer tubing (outer diameter 3.0 mm; inner diameter 2.5 mm) containing a radiochromic dye solution (1-3). The ends of the tubing are sealed with a small glass bead which also serves to transmit analyzing light in the Opti-Chromic Spectrophotometric Reader (2).

800,012

PB88-177506

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Optical Waveguides with Liquid Core in Spectrophotometry.

Final rept.,

B. B. Radak, W. L. McLaughlin, and M. G. Simic.

1987, 6p

Pub. in J. Serb. Chem. Soc. 52, n6-7 p405-410 1987.

Keywords: *Dosimetry, *Fiber optics, Food irradiation, Gamma radiation, Optical waveguides, Optichromic, Quality control, Radiation processing, Reprints, *Spectrophotometry.

A method is described of using spectrophotometer in optical waveguide mode, different from the conventional way with direct rectilinear passage of the analyzing light through the cell. It can be applied to all transparent liquids whose refractive index is higher than that of the container (Teflon tubing being the best choice by now). A high reproducibility of better than plus or minus 1 percent was achieved, and it is proven that quantitative measurements in the concentration region of 10 to the minus ten power mol l (-1) are possible with this method.

800,013

PB88-189196

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Thin Film Recording Medium for Use in Food Irradiation.

Final rept.,

M. C. Saylor, T. T. Tamargo, W. L. McLaughlin, H. M. Khan, D. F. Lewis, and R. D. Schenfele. 1988, 8p

Sponsored by GAF Chemicals Corp., Bound Brook, NJ.

Pub. in Radiation Physics and Chemistry 31, n4-6 p529-536 1988.

Keywords: Dosimetry, Quality assurance, Reprints, *Film dosimeters, *Food irradiation, Gamma radiation, Radiation processing, Scanning densitometry, Spectrophotometry, Thin films.

A commercially-available electron recording medium has been examined in terms of response to ionizing radiation in the form of photons emitted from the radionuclides (¹³⁷Cs) and (⁶⁰Co) and accelerated electrons. Operational characteristics of the film have been evaluated using scanning visible spectrophotometry, color photometry, densitometry, and scanning densitometry. The effect of various irradiation parameters (absorbed dose, absorbed dose rate, and irradiation temperature) have been characterized over the absorbed dose range of 0.1 to 5 kGy. Principle attributes of the film appear to be dose-rate independence for a given source, a high degree of uniformity with respect to radiochromic dye coating, and reproducibility of individual film sample measurements. Methods of dosimetry system operation and potential applications are discussed, with emphasis on applications for food irradiation.

800,014

PB88-200282

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Theoretical and Computational Aspects of Migration of Package Components to Food.

Final rept.,

S. S. Chang, C. M. Guttman, I. C. Sanchez, and L. E. Smith. 1988, 12p

Pub. in ACS (American Chemical Society) Symposium Series 365 Food Packaging Interactions, p106-117 1988.

Keywords: *Food packaging, Food industry, Migrations, *Fickian diffusion.

The numerical solutions and computational methods for the normal Fickian diffusion process applicable to packaging material is given in detail. Most experimental observations on the migration of small molecules from polymeric package materials into food or food simulating solvents show some non-Fickian behavior. A model for a solute diffusing in a swelling polymer is used to explain this phenomenon. In certain cases where the solvent is not stirred or is highly viscous, the quiescent migration is found to depend on the diffusion coefficient of the migrant in the solvent. Either alone or in combination, these models can be applied to describe most migration behavior in rubbery or semicrystalline packaging material.

ASTRONOMY & ASTROPHYSICS

Astrophysics

800,015

PB88-176854

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Detection of X-ray Emission from the Young Low-Mass Star Rossiter 137B.

Final rept.,

O. Vilhu, and J. L. Linsky. 1987, 5p

Contract NAG8-596

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in Publications of the Astronomical Society of the Pacific 99, p1071-1075 Oct 87.

Keywords: Binary stars, Dwarf stars, Reprints, *X-ray binaries, X-ray sources, Cosmic x-ray sources, Companion stars, HEAO 2.

The authors have detected Rst 137B, a close M-dwarf companion to the active K-star IJ 36705, from a High Resolution Image in the EINSTEIN Archive. The X-ray surface fluxes (0.2-4 keV) from both stars are close to the empirical saturation level, E(x)/F(bol) approx = 1000, defined by rapid rotators and very young stars. This supports the earlier results of the youthfulness of the system. The young couple is an excellent subject for studies of dependence of early evolution on stellar mass. Rst 137B is one of the latest spectral types and thus lowest-mass pre-main-sequence stars yet detected as an X-ray source.

800,016

PB88-187547

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

VLA Observations of Rapid 6 cm Flux Variations in alpha Ori.

Final rept.,

J. A. Bookbinder, R. E. Stencel, S. A. Drake, T.

Simon, J. L. Linsky, and D. Florkavski. 1987, 3p

Grant NGL-06-003-057

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in Proceedings of Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun (5th), Boulder, CO., July 7-11, 1987, p337-339.

Keywords: Extraterrestrial radio waves, *Alpha Ori star, Late stars, Stellar radiation.

The authors present a series of VLA observations designed to monitor the 6 cm flux density variations of alpha Ori. Their results indicate that variability is present at the 30%-40% level on timescales of several weeks. These timescales are probably inconsistent with any global or large-scale processes.

800,017

PB88-187562

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Radio-Continuum Survey of the Coolest M and C Giants.

Final rept.,

S. A. Drake, J. L. Linsky, and M. Elitzur. 1987, 11p

Grant NGL-06-003-057

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in Astronomical Jnl. 94, n5 p1280-1290 Nov 87.

Keywords: *Giant stars, Reprints, *Supergiant stars, Late stars, Stellar mass ejection, Stellar chromospheres, Stellar winds.

The authors present the results of a sensitive VLA continuum survey of 22 cool M and C type giants and supergiants, including nine carbon stars, one S type star, and 12 M stars. The purpose of the survey was to probe the physical properties of the partially ionized,

ASTRONOMY & ASTROPHYSICS

Astrophysics

expanding chromospheres of the coolest luminous stars.

800,018
PB88-187612 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Pulsations of White Dwarf Stars with Thick Hydrogen or Helium Surface Layers.

Final rept.,
A. N. Cox, S. G. Starrfield, R. B. Kidman, and W. D. Pesnell. 1987, 22p
Pub. in *Astrophysical Jnl.* 317, p303-324, 1 Jun 87.

Keywords: Stability, Reprints, *White dwarf stars, *Stellar oscillations, *Stellar pulsations.

Models for DA white dwarf stars with effective temperatures between 9000 and 12,000 K and models for DB white dwarfs with effective temperatures of 25,000 K and 27,000 K have been tested for stability against both radial and nonradial pulsations.

800,019
PB88-189048 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

X-ray Halos in Galaxies and Clusters of Galaxies: Theory.

Final rept.,
C. L. Sarazin. 1987, 17p
Contract NAGW-764, Grant NSF-AST81-20260
Sponsored by National Science Foundation, Washington, DC., and National Aeronautics and Space Administration, Washington, DC.
Pub. in *Dark Matter in the Universe*, p183-199 1987.

Keywords: *Galaxies, Reprints, *Dark matter, *Galactic clusters, Halos, X ray astronomy.

X-ray measurements provide an excellent method to determine the amount and distribution of the dark matter in clusters. Unfortunately, accurate temperature profiles, necessary to this method, are currently not available. However, if the intracluster gas is assumed to have a monotonically decreasing temperature, one finds that the dark matter is strongly concentrated to the cluster center, and has a mass which only exceeds the known baryonic mass by a factor of about three. On a second topic, cooling flows are shown to be a very common feature of cluster central and normal elliptical galaxies. The cooling gas is probably ultimately converted into low mass stars.

800,020
PB88-189055 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Rotational Modulation and Flares on RS CVn and BY Dra Stars IV. The Spatially Resolved Chromosphere of AT Lacertae.

Final rept.,
F. M. Walter, J. E. Neff, D. M. Gibson, J. L. Linsky, M. R. Rodono, D. E. Gary, and C. J. Butler. 1987, 14p
Contract NAG5-26409
See also PB88-152020. Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in *Astron. Astrophys.* 186, p241-254 1987.

Keywords: Stellar atmospheres, Binary stars, Radio astronomy, Reprints, *Stellar flares, *Starspots, Stellar chromospheres, IUE.

The authors observed the RS Canum Venaticorum system AR Lacertae systematically over an orbital period with the International Ultraviolet Explorer in October 1983. Contemporaneous radio observations were obtained at the Very Large Array (VLA). The spectra of the MgII k emission line were analyzed using a Doppler imaging technique. In this way, the authors identified three discrete regions of emission in the outer atmosphere of the K star - two 'plages' and a chromospheric brightening that was related to a radio flare.

800,021
PB88-189089 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Pitch-Angle Anisotropy of Low-Energy Ions at Interplanetary Shocks.

Final rept.,
J. G. Kirk. 1988, 9p
Pub. in *Astrophysical Jnl.* 324, p557-565, 1 Jan 88.

Keywords: Pitch(Inclination), Magnetic storms, Shock waves, Anisotropy, Magnetosphere, Reprints, *Energetic particles, Bow waves, Particle acceleration.

Low-energy ions at interplanetary shocks have speeds similar to that of the background plasma. Under these conditions, the pitch-angle scattering which they are thought to undergo, and which is required if they are to be accelerated by the first-order Fermi mechanism, does not imply that the upstream distribution is nearly isotropic. The diffusion approximation must, therefore, be abandoned. A theory of anisotropic transport, previously used to treat acceleration at parallel relativistic shocks, is applied to this situation, leading to predictions of the pitch-angle distribution in the precursor to the shock. In situ measurements of the pitch-angle distribution of 30 keV ions, which have a speed of about 6 times that of the shock, show moderate anisotropies which agree well with the predictions of the diffusion approximation. In this case, the new theory demonstrates that the exact anisotropy is indeed well represented by the diffusion approximation.

800,022
PB88-189097 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Mass Distributions in Elliptical Galaxies at Large Radii.

Final rept.,
C. L. Sarazin. 1987, 10p
Pub. in *Structure and Dynamics of Elliptical Galaxies*, p179-188 1987.

Keywords: *Galaxies, *Mass, X rays, Reprints, *Elliptical galaxies, Dark matter, Halos, M87 galaxy.

Recently, x-ray observations have shown that elliptical galaxies generally contain large quantities of hot gas. Central dominant cluster ellipticals have even more gas, which they have accreted from the surrounding clusters. The mass distributions in these galaxies can be derived from the condition of hydrostatic equilibrium. M87, the best studied central dominant galaxy, has a massive, dark halo with a total mass of about 4×10^{12} to the 12th power solar masses within a radius of 300 kpc. The x-ray observations of normal ellipticals also strongly suggest that they have heavy haloes, although the distribution of the mass is much less certain than in M87.

800,023
PB88-189113 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

High-Resolution IUE Observation of the Line of Sight to Nova V693 Corona Austrinae 1981.

Final rept.,
E. M. Sion, S. G. Starrfield, M. E. VanSteenberg, W. M. Sparks, J. W. Turan, and R. E. Williams. 1986, 5p
Pub. in *Astronomical Jnl.* 92, n5 p1145-1149 Nov 86.

Keywords: *Novae, Stellar spectra, Emission spectra, Reprints, *V693 Corona Austrinae 1981 Nova, IUE.

The authors have analyzed an IUE echelle image of nova V693 Corona Austrinae 1981 obtained 12 days after its outburst. Broad (30-40 Å full width) emission lines dominate its spectrum and generally confirm the difficult identifications of emission features present in its low-resolution spectrum taken 12 days after outburst. Numerous sharp absorption lines of low-, intermediate-, and high-ionized metal species are present in the line of sight, to the nova but none show any appreciable velocity shifts beyond a deduced average interstellar medium velocity. Approximate column densities have been determined, by using the weak line approximation and, wherever possible, by constructing curves of growth. A hydrogen column is deduced.

800,024
PB88-190129 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.

Refining the Estimate of the Gravitational Constant.

Final rept.,
B. W. Rust, and J. H. Dunn. 1985, 1p
Pub. in *Bulletin of the American Astronomical Society* 17, n2 p550 1985.

Keywords: *Fundamental constants, Gravity, Reprints, *Gravitational constant.

J. W. Beams and colleagues at the University of Virginia have developed an ingenious variant of the Caven-

dish experiment mounted on a rotating table driven by a torquer which senses the position of the torsion pendulum by optical-electrical feedback and accelerates the table to maintain a constant angle between the large and small mass systems, thus keeping the latter stationary in the rotating reference frame. (*Physics Today*, 24, May 1971, 35), the value of G is obtained from the rotational acceleration of the table. At the National Bureau of Standards, G. G. Luther, et. al., used the method to measure a precise time-series of table deflections which they fitted with a cubic polynomial to get G from the quadratic term (*Atomic Masses and Fundamental Constants 5*, Plenum Press, 1976, 592). Their residuals were five orders of magnitude smaller than the measurements but exhibited a strong second harmonic periodicity caused by the background mass distribution. The authors obtain a new estimate of G which accounts for this effect by fitting the differential equations for a critically damped, non-linear pendulum to the data. Our fit produces white noise residuals that are an order of magnitude smaller than those from the cubic polynomial model.

800,025
PB88-193727 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Epsilon Aurigae in an Evolutionary Context.

Final rept.,
R. F. Webbink. 1985, 11p
Pub. in *Proceedings of Workshop on the 1982-1984 Eclipse of Epsilon Aurigae*, Tucson, AZ., January 16-17, 1985, p49-59.

Keywords: *Binary stars, *Stellar evolution, *Epsilon Aurigae stars, Supergiant stars.

Basic observational data of Epsilon Aurigae are summarized and used as the basis of a discussion of possible evolutionary states of the system. Constraints posed by the presence of a cold disk surrounding the secondary star are also outlined.

800,026
PB88-193735 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Status Report on the SYNOP Project to Monitor Stars with High Resolution Spectroscopy.

Final rept.,
J. L. Linsky. 1987, 3p
Pub. in *Proceedings of Cambridge Workshop on Cool Stars, Stellar Systems and the Sun (5th)*, Boulder, CO., July 7-11, 1987, p483-485.

Keywords: *Astronomical spectroscopy, Stars, *Stellar spectrophotometry, SYNOP project, High resolution.

The report summarizes the rationale, scientific programs, and design considerations for a proposed high resolution spectroscopic monitoring facility.

800,027
PB88-195102 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Sobolev Approximation for the Line Force and Line Source Function in a Spherically-Symmetrical Stellar Wind with Continuum Opacity.

Final rept.,
J. Puls, and D. G. Hummer. 1988, 12p
Grant NSF-AST85-05919, Contract NASA-NAGW-766
Sponsored by National Science Foundation, Washington, DC., and National Aeronautics and Space Administration, Washington, DC.
Pub. in *Astronomy and Astrophysics* 191, p87-98 1988.

Keywords: Spectral lines, Reprints, *Stellar winds, Sobolev approximation, Early stars, O stars, Wolf-Rayet stars, Radiative transfer.

An expression for the force arising from diffuse line radiation is derived in the context of the Sobolev approximation for spectral line formation, as generalized by Hummer and Rybicki (1985) to include the effects of continuous opacity and emissivity in a general three-dimensional gas flow. The theory is then specialized to spherical symmetry and used to calculate the line source function and radiative pressure gradient in model stellar winds simulating essential aspects of the outflows characteristic of O-stars and Wolf-Rayet objects.

800,028

PB88-195110 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

C/He Abundances in WC Stars.

Final rept.,
L. F. Smith, and D. G. Hummer. 1988, 24p
Contract NASA-NAGW-766, Grant NSF-AST85-05991
Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Monthly Notices of the Royal Astronomical Society 230, p511-534 1988.

Keywords: *Stars, *Carbon, *Helium, Stellar spectra, Infrared spectra, Stellar atmospheres, Abundance, Reprints, Wolf-Rayet stars.

The C/He abundances in 17 southern WC stars have been derived from spectra in the H and K bands using, for the most part, recombination theory with allowance for collision redistribution.

800,029

PB88-196811 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Review of the Classical Nova Outburst.

Final rept.,
S. Starrfield, and W. M. Sparks. 1987, 15p
See also DE86-015337.
Pub. in Astrophysics and Space Science 131, p379-393 1987.

Keywords: *Novae, Binary stars, Reprints, White dwarf stars.

The authors review the recent observational and theoretical studies of the nova outburst. The observational studies have not only identified a new class of novae, but theoretical simulations of this class have been found to be in excellent agreement with the observations. This new class consists of outbursts occurring on ONeMg white dwarfs in close binary systems, in contrast to the other outbursts which are occurring on CO white dwarfs. They also review the effects of the beta (+)-unstable nuclei and show how their presence has a major effect on the evolution.

800,030

PB88-198940 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Discovery of Nonthermal Radio Emission from Magnetic Bp-Ap Stars.

Final rept.,
S. A. Drake, D. C. Abbott, T. S. Bastian, J.H. Biegging, E. Churchwell, G. Dulk, and J. L. Linsky. 1987, 7p
Contract NASA-NAGW-766, Grant NGL-06-003-057
Sponsored in part by Grant NSF-AST85-05919. Sponsored by National Science Foundation, Washington, DC., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 322, p902-908, 15 Nov 87.

Keywords: *Radio sources(Astronomy), Reprints, *Magnetic stars, B stars, A stars.

In a VLA survey of chemically peculiar B- and A-type stars with strong magnetic fields, the authors have detected five of the 34 stars observed as 6 cm continuum sources. Three of the detections are helium-strong early Bp stars, and two are helium weak, silicon-strong stars with spectral types near A0p. Three-frequency observations indicate that the helium-strong Bp stars are variable nonthermal sources. The emission cannot arise from a stellar wind, but is consistent with gyro-synchrotron emission from continuously injected, mildly relativistic particles trapped in the magnetosphere formed by the closed field regions of the strong surface magnetic fields. The number density of these energetic particles must increase with radius in order for the observed fluxes to be fitted by the model.

800,031

PB88-204573 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Chromospheric and Coronal Heating in a Volume-Limited Sample of K Dwarfs.

Final rept.,
D. H. Neff, J. A. Bookbinder, and J. L. Linsky. 1987, 3p
Contract NASA-NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Cambridge Workshop on Cool Stars, Stellar Systems and the Sun (5th), Boulder, CO., July 7-11, 1987, p161-163.

Keywords: *Dwarf stars, Ultraviolet spectra, Magnesium, *Stellar chromospheres, *Stellar coronas, Soft x radiation.

The chromospheric and coronal emission levels in an essentially bias-free sample of K dwarfs was compared. A rough power law relation was found between the normalized soft x-ray flux and the Mg II h + k flux. Further evidence was found of a minimum surface flux level for Mg II h + k emission in cool dwarfs.

800,032

PB88-204904 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Collisional-Radiative Switching: A Powerful Technique for Converging Non-LTE Calculations.

Final rept.,
D. G. Hummer, and S. A. Voels. 1988, 2p
Grant NSF-AST85-05919
Sponsored by National Science Foundation, Washington, DC., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Astronomy and Astrophysics 192, p279-280 1988.

Keywords: *Stellar atmospheres, *Stars, Reprints.

The authors have developed a very simple technique to converge statistical equilibrium and model atmosphere calculations in extreme non-LTE conditions, when the usual iterative methods fail to converge from a LTE starting model. The technique is based on a smooth transition from a collision-dominated LTE situation to the desired non-LTE conditions in which radiation dominates, at least in the most important transitions.

800,033

PB88-217302 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Office of Nondestructive Evaluation.

Collision-Induced Rototranslational Absorption Spectra of H2-He Pairs at Temperatures from 40 to 3000 K.

Final rept.,
J. Borysow, L. Frommhold, and G. Birnbaum. 1988, 7p
Pub. in Astrophysical Jnl. 326, p509-515, 1 Mar 88.

Keywords: *Hydrogen, *Helium, Planetary atmospheres, Stellar atmospheres, Absorption spectra, Mixtures, Reprints, Cool stars.

The authors calculate the zeroth, first, and second moments of the rototranslational collision-induced absorption (RT CIA) spectra of hydrogen-helium mixtures from the fundamental theory, for temperatures from 40 to 3000 K. With the help of simple analytical functions of three parameters and the information given, the RT CIA spectra of H2-He pairs can be generated on computers of small capacity, with rms deviations from exact quantum profiles of not more than a few percent. Such representations of the CIA spectra are of interest for work related to the atmospheres of the outer planets and cool stars. The theoretical spectra are in close agreement with existing laboratory measurements at various temperatures from about 77 to 3,000 K.

800,034

PB88-228143 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Second Generation Spectrography for the Hubble Space Telescope.

Final rept.,
B. E. Woodgate, A. Boggess, T. R. Gull, S. R. Heap, V. L. Krueger, S. P. Maran, R. W. Melcher, F. J. Rebar, H. D. Vitagliano, R. F. Green, S. C. Wolff, J. B. Hutchings, E. B. Jenkins, J. L. Linsky, H. W. Moos, F. Roesler, R. A. Shine, J. F. Timothy, D. E. Weistrop, M. Bottema, and W. Meyer. 1986, 13p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrument Engineers), v627 pt1 p350-362 1986.

Keywords: *Spectrographs, Spectrophotometry, Far ultraviolet radiation, Near ultraviolet radiation, Near infrared radiation, *Hubble space telescope, Visible radiation.

A preliminary design is presented for the Space Telescope Imaging Spectrograph (STIS), which has been selected by NASA for definition study for future flight as a second generation instrument on the Hubble Space Telescope (HST). STIS is a two-dimensional spectrograph that will operate from 1050-11000 Å at the limiting HST resolution of 0.05 arcsec FWHM, with spectral resolutions of 100, 1,200, 20,000, and 100,000 and a maximum field-of-view of 50 x 50 arcsec. Its basic operating modes include echelle mode (like IUE), long slit mode (for simultaneous spectra at 1000 positions on the target), slitless spectrograph mode, coronagraphic spectroscopy, photon time-tagging and direct imaging. Photon counting MAMA detectors are used in the UV, while large format cooled CCDs are the visible and near-IR detectors. Research objectives are active galactic nuclei, the intergalactic medium, global properties of galaxies, the origin of stellar systems, stellar spectral variability, and spectrographic mapping of solar system processes.

800,035

PB88-228192 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Fast and Accurate Method for Evaluating the Non-relativistic Free-Free Gaunt Factor for Hydrogenic Ions.

Final rept.,
D. G. Hummer. 1988, 8p
Contract NAGW-766, Grant NSF-AST85-05919
Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 327, p477-484, 1 Apr 88.

Keywords: *Bremsstrahlung, Absorption, Reprints, *Gaunt factors, Stellar opacity.

A two-dimensional Chebyshev expansion of the non-relativistic hydrogenic free-free Gaunt factor is presented which can be evaluated extremely rapidly and which gives a maximum relative error of 0.7 percent over a very wide range of temperatures and frequencies: $-4.0 = \text{or} < \log(h\nu/kT) < \text{or} = 1.5$ and $-3.0 < \text{or} = \log(Z \text{ squared}) Ry/kT < \text{or} = 3$. The expansion is obtained from numerical values computed primarily from the exact expressions of Karzas and Latter, augmented by certain analytic approximations that are valid in regions of the energy plane where the series given by Karzas and Latter become computationally intractable. A brief table of thermally averaged Gaunt factors is given that covers the ranges of microgram $= h\nu/kT$ and gamma squared $= (Z \text{ squared}) Ry/kT$ mentioned above in intervals of 0.25 dex.

800,036

PB88-228234 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Proposed Columbus Mission: High and Low Resolution Spectroscopy in the 100-2000 Å Spectral Region.

Final rept.,
J. L. Linsky. 1985, 4p
Pub. in Proceedings of International Colloquium on Ultraviolet and X-ray Spectroscopy of Astrophysical and Laboratory Plasma (8th), IAU Colloq. 86, p72-75 1985.

Keywords: Far ultraviolet radiation, Ultraviolet spectra, Ultraviolet spectroscopy, *Ultraviolet astronomy, *Columbus space station.

NASA and ESA scientists are defining the scientific objectives and instrument parameters for a proposed satellite called Columbus that will observe astronomic objects with very high spectral resolution in the 900 - 1200 Å spectral region and moderate resolution in the 100 - 2000 Å spectral region.

800,037

PB88-228267 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

ASTRONOMY & ASTROPHYSICS

Astrophysics

Physics of Partial Redistribution and Radiative Transfer in Stellar Atmospheres.

Final rept.,
J. L. Linsky. 1987, 43p
Contract NAG5-82, Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Radiative Properties of Hot Dense Matter III, p333-375 1987.

Keywords: *Stellar atmospheres, Solar atmosphere, Reprints, *Radiative transfer, Stellar models, Magnesium ions, Lyman lines.

The term partial redistribution refers to the redistribution in frequency and angle in the observer's frame when the scattering process in the atom's frame contains both coherent and noncoherent components. Astronomers often must solve the radiative transfer equation including partial redistribution when they wish to derive the temperature and density structure of a stellar atmosphere from the analysis of the observed profiles of strong resonance lines. In the review paper the author discusses the physical processes that lead to coherent and noncoherent scattering in the atom's frame, and the various types of redistribution functions commonly used in astrophysics. Several important examples are given of partial redistribution calculations of the hydrogen Lyman alpha and Mg(1+) resonance lines formed in static plane-parallel models for the solar atmosphere and stellar atmospheres. Computed profiles are shown for geometrically extended and expanding atmospheres when the radiative transfer equation, including partial redistribution, must be solved in the comoving frame of the fluid.

800,038

PB88-228275 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

IUE Observations of Neutral Hydrogen and Deuterium in the Local Interstellar Medium.

Final rept.,
W. B. Landsman, J. Murthy, R. C. Henry, H. W. Moos, J. L. Linsky, A. Vidal-Madjar, and C. Gry. 1986, 4p
Pub. in Advances in Space Research 6, p87-90 Dec 86.

Keywords: *Interstellar matter, *Hydrogen, *Deuterium, Ultraviolet spectra, Reprints, Late stars, IUE.

Small-aperture, high-dispersion IUE spectra have been obtained of seven late-type stars that, in general, confirm previous Copernicus results concerning the distribution of hydrogen and deuterium in the local interstellar medium. In addition, the IUE Ly alpha spectra of Altair, and of the alpha Cen components, suggest that multiple velocity components exist in these two directions.

800,039

PB88-228317 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Requirements for Theoretical Models of Outflows.

Final rept.,
J. L. Linsky. 1988, 16p
Contract NAG5-82, Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Torino Workshop Mass Outflows from Stars and Galactic Nuclei (2nd), Torino, Italy, May 4-8, 1987, p177-192 1988.

Keywords: Ultraviolet spectra, Reviews, Bibliographies, *Stellar mass ejection, *Galactic nuclei, Mass loss, Stellar models.

The paper is the concluding review of the Workshop on Mass Outflows from Stars and Galactic Nuclei held at Torino, Italy May 4-8, 1987. The paper highlights the potential sources of misunderstanding and misinterpretation that often occur when inferring stellar mass loss rates from spectroscopic data. It then proceeds to describe some of the essential physical processes that should be included in theoretical descriptions of mass loss. These include: (1) the importance of identifying whether the energy and momentum is added to the outflow, above or below the critical point; (2) specifying the process controlling the density at the critical point; (3) including several mass mechanisms when they work together; (4) the inclusion of instabilities and phase changes, and other topics. An extensive bibliography is included.

800,040

PB88-230305 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Failure of Continuum Methods for Determining the Effective Temperature of Hot Stars.

Final rept.,
D. G. Hummer, D. C. Abbott, S. A. Voels, and B. Bohannan. 1988, 5p
Contract NAGW-766, Grant NSF-AST85-05919
Sponsored by National Science Foundation, Washington, DC., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 328, n2 p704-708, 15 May 88.

Keywords: *Stellar atmospheres, Temperature, Gravity, Hydrogen, Helium, Reprints, *Hot stars.

The authors demonstrate that for hot stars ($T_{\text{eff}} > 30,000$ K), methods based on the integrated continuum flux are completely unreliable discriminators of the effective temperature. In evidence of the conclusion, they show that the observed continuum flux distribution of zeta Pup (O4f) can be fitted to within the observational errors by photospheric models having a wide range of effective temperatures and gravities. In contrast, absorption line profiles provide much more accurate values of these parameters. As an example, profiles of weak lines of H I, He I, and He II are computed from standard non-LTE models at the effective temperature and surface gravity inferred by Underhill from the continuous energy flux.

800,041

PB88-230347 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Steady State Models of White Dwarfs Accreting Helium or Carbon/Oxygen-Rich Matter.

Final rept.,
Y. Kawai, H. Saio, and K. Nomoto. 1988, 6p
Contract DE-AC02-76CH00016
Sponsored by Department of Energy, Washington, DC.
Pub. in Astrophysical Jnl. 328, p207-212, 1 May 88.

Keywords: Helium, Carbon, Oxygen, Steady state, Reprints, *White dwarf stars, *Stellar models, Accretion.

The authors have calculated steady state models of white dwarfs which accrete helium or carbon/oxygen (C + O)-rich matter. The helium accreting model consists of a highly degenerate C + O core and a helium burning shell, overlaid by a helium envelope. The C + O accreting model consists of a highly degenerate O + Ne + Mg core, a carbon burning shell, and a C + O envelope. The accretion rate is assumed to be equal to the burning rate of the matter.

800,042

PB88-230446 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Applications of the Doppler Imaging Technique to the Analysis of High-Resolution Spectra of the 3 October 1981 Flare on V711 Tauri.

Final rept.,
J. L. Linsky, and J. E. Neff. 1988, 3p
Contract NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Impact of Very High S/N Spectroscopy on Stellar Physics, p231-233 1988.

Keywords: Binary stars, Ultraviolet spectra, Stellar spectra, Doppler effect, Reprints, *Stellar flares, Stellar chromospheres.

An unconstrained four gaussian fit to the Mg II profile near the flare peak indicates that the flare occurred near the central meridian of the K1 IV star, perhaps above a spot. A more likely fit to the same data places the flare at +90 + or - 30 km/s relative to the K1 IV star, indicating significant downflowing plasma.

800,043

PB88-230453 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Radial Pulsation in Luminous Hot Helium Stars.

Final rept.,
H. Saio, and C. S. Jeffery. 1988, 12p
Pub. in Astrophysical Jnl. 328, p714-725, 15 May 88.

Keywords: Pulsation, Reprints, *B stars, Helium stars, Hot stars.

Radial pulsations in hydrogen-deficient stars have been studied by calculating linear nonadiabatic pulsation frequencies and by reexamining the observed properties for systematic effects. The observed periods of the variable hydrogen-deficient stars decrease as a function of effective temperature. The observational surface gravity-effective temperature diagram seems to indicate that nonvariable extreme helium stars have smaller luminosity-to-mass ratios than variable helium stars.

800,044

PB89-107148 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Recombination Line Intensities for Hydrogenic Ions-II. Case B Calculations for C VI, N VII and O VIII.

Final rept.,
P. J. Storey, and D. G. Hummer. 1988, 6p
Contract NAGW-766
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Monthly Notices of the Royal Astronomical Society 231, p1139-1144 1988.

Keywords: Line spectra, Reprints, *Multicharged ions, *Carbon ions, *Nitrogen ions, *Oxygen ions, *Radiative recombination, Wolf-Rayet stars.

The intensities of recombination lines of C(VI), N(VII) and O(VIII) are calculated, accounting for both electron and heavy particle collisions and assuming Case B of Baker & Menzel. The intensities of lines formed by transitions $n \text{ sub } \mu \rightarrow n \text{ sub } l$ are tabulated for $n \text{ sub } \mu = \text{ or } < 50$, $n \text{ sub } l = \text{ or } < 29$, at $\log N \text{ sub } e = 4(1)13$ and at 10 values of electron temperature in the interval 10,000 K = or < T sub e = or < 500,000 K.

800,045

PB89-123681 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Equation of State for Stellar Envelopes. 1. An Occupation Probability Formalism for the Truncation of Internal Partition Functions.

Final rept.,
D. G. Hummer, and D. Mihalas. 1988, 21p
Contract NAGW-766
See also PB89-123699. Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 331, p794-814, 15 Aug 88.

Keywords: *Equations of state, Free energy, Reprints, *Stellar envelopes, Stellar oscillations, Partition functions, High temperature plasmas.

The authors have formulated a new equation of state for material in stellar envelopes, subject to the limits $T \text{ approx } = \text{ or less than } 10 \text{ million K}$ and $\rho \text{ approx } = \text{ or less than } 0.01 \text{ g/cc}$. Under these conditions, the method of free energy minimization can be used to allow for nonideal effects; this method ensures thermodynamic consistency among the material properties. A chemical picture is used in which atomic and molecular particles retain their identities. The free energy can then be expressed as the sum of several terms representing such effects as partial degeneracy of the electrons, Coulomb interactions among charged particles, finite-volume, hard sphere repulsion and van der Waals attraction, in addition to the usual terms representing the translational and internal degrees of freedom. An occupation probability formalism is used to represent the effects of the plasma in establishing a finite partition function, and attention is paid to representing these effects in a way that is consistent from the point of view of statistical mechanics.

800,046

PB89-123699 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Equation of State for Stellar Envelopes. 2. Algorithm and Selected Results.

Final rept.,
D. Mihalas, W. Dappen, and D. G. Hummer. 1988, 11p
Contract NAGW-766
See also PB89-123681 and PB89-123707. Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 331, p815-825, 15 Aug 88.

Keywords: *Equations of state, Free energy, Gas ionization, Dissociation, Reprints, *Stellar envelopes, Partition functions, Pressure effects, Hydrogen plasma, Helium plasma.

The authors discuss a free-energy-minimization method for computing the dissociation and ionization equilibrium of a multicomponent gas. The adopted free energy includes terms representing the translational free energy of a partially degenerate electron gas; and the configurational free energy from shielded Coulomb interactions among charged particles. Internal partition functions are truncated using an occupation probability formalism that accounts for perturbations of bound states by both neutral and charged perturbers. The entire theory is analytical and differentiable to all orders, so it is possible to write explicit analytical formulae for all derivatives required in a Newton-Raphson iteration; these are presented to facilitate future work. Some representative results for both Saha and free-energy minimization equilibria are presented for a hydrogen-helium plasma with $N(\text{He})/N(\text{H}) = 0.10$. These illustrate nicely the phenomena of pressure dissociation and ionization, and also demonstrate vividly the importance of choosing a reliable cutoff procedure for internal partition functions.

800,047
PB89-123707 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Equation of State for Stellar Envelopes. 3. Thermodynamic Quantities.

Final rept.,
W. Dappen, D. Mihalas, D. G. Hummer, and B. W. Mihalas. 1988, 10p
Contract NAGW-766
See also PB89-123699. Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in *Astrophysical Jnl.* 332, n1 p261-270, 1 Sep 88.

Keywords: *Equations of state, Free energy, Ionized gases, Thermodynamic properties, Dissociation, Reprints, *Stellar envelopes, Stellar oscillations, Hydrogen plasma, Helium plasma.

The authors derive general formulae for the computation of the thermodynamic properties of a partially ionized (and/or dissociated) multicomponent gas in terms of second derivatives of the free energy with respect to temperature, volume, and occupation numbers. For the free energy used in the author's previous work, they give explicit analytical expressions for all derivatives required to construct the thermodynamic quantities. Representative results for several different thermodynamic properties of a hydrogen-helium plasma with $N(\text{He})/N(\text{H}) = 0.10$ are presented as color plots, which make the qualitative behavior of the results readily comprehensible over a large temperature-density domain.

800,048
PB89-123772 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Ultraviolet Emission Lines and Optical Photometry of the Flare Star AT Microscopii.

Final rept.,
O. Elgaroy, P. Joras, O. Engvold, E. Jensen, B. R. Pettersen, T.R. Ayres, C. Ambruster, J. L. Linsky, M. Clark, W. Kunkel, and F. Marang. 1988, 11p
Pub. in *Astronomy and Astrophysics* 193, p211-221 1988.

Keywords: Ultraviolet spectra, Emission spectra, Dwarf stars, Binary stars, Photometry, Reprints, *Flare stars, *AT Microscopii star, Late stars, Stellar chromospheres, IUE.

Ultraviolet spectra of the dwarf flare star binary AT Mic (dm 4.5e + dm 4.5e) were obtained with the IUE spacecraft on three days in September 1985. A high resolution short-wavelength spectrum was exposed for 25 hours, the longest observation taken with the IUE to date, nevertheless only a few of the stronger emission lines were seen above the noise. Simultaneous optical monitoring in the U-band was performed during part of the IUE observations. At the time of observation AT Mic was flaring at an average rate of 1.3 flares per hour. On the average 9% of the energy in the U-band was due to the detected flare activity.

800,049
PB89-132914 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Active Late-Type Stars.

Final rept.,
J. L. Linsky. 1988, 44p
Grants NGL-06-003-057, NASA-NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in *Multiwavelength Astrophysics*, p49-92 1988.

Keywords: Ultraviolet spectra, X rays, Reprints, *Stellar activity, *Late stars, Stellar magnetic fields, Stellar chromospheres, Stellar coronas, Starspots.

In the chapter, the author presents a summary (by no means complete) of stellar activity. Two essential themes are emphasized. The first is that magnetic fields control the energetics and dynamics of active phenomena. Since these fields thread the full range of a stellar atmosphere, from the photosphere to the corona, active phenomena at all heights and temperatures are coupled. The second theme is that coordinated or simultaneous observations in very different wavelength regions are needed to understand active phenomena, because they encompass plasma with a wide range of temperatures and include a nonthermal high-energy component. An extensive bibliography is included.

800,050
PB89-132948 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Multiwavelength Observations of Magnetic Fields and Related Activity on XI Bootis A.

Final rept.,
S. H. Saar, J. Huovelin, M. S. Giampapa, J. L. Linsky, and C. Jordan. 1988, 4p
Grant NGL-006-03-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in *Activity in Cool Star Envelopes*, p45-48 1988.

Keywords: *Dwarf stars, Reprints, *Magnetic stars, Stellar magnetic fields, Stellar chromospheres, Stellar coronas, Stellar activity.

Preliminary results are presented of coordinated observations of magnetic fields and related activity on the active dwarf, xi Boo A. Combining the magnetic fluxes with the linear polarization data, the authors construct a simple map of the stellar active regions.

Cosmic Ray Research

800,051
PB88-189121 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Fermi Acceleration at Shocks with Arbitrary Velocity Profile.

Final rept.,
P. Schneider, and J. Kirk. 1987, 4p
Contract NAGW-766
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in *Astrophysical Jnl.* 323, pL87-L90, 1 Dec 87.

Keywords: *Cosmic rays, Shock waves, Reprints, *Particle acceleration, Space plasmas.

Diffusive particle acceleration in modified shock fronts is considered. The authors outline a method by which one can obtain the resulting particle spectrum for an arbitrary flow profile; the method is based on a reformulation of the transport equation as a nonlinear first-order equation. Besides the shape of the flow profile, the spectral index of particles depends on the Peclet number of the shock. Results are given for some sample profiles.

800,052
PB88-195128 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Cosmic Ray Acceleration at Relativistic Shocks.

Final rept.,
J. G. Kirk, and P. Schneider. 1988, 3p
Pub. in *Proceedings of Conference of George Mason Fall Workshop on Astrophysics 'Supermassive Black Holes' (3rd)*, Fairfax, VA., October 14-16, 1986, p322-324 1988.

Keywords: *Cosmic rays, Shock waves, Legendre functions, Transport theory, Eigenvectors, Eigenfunc-

tions, Jets, Particle acceleration, Galactic nuclei, Relativistic range.

The authors have solved the simplest problem of the acceleration of cosmic rays at shocks with arbitrary upstream and downstream velocities of the bulk fluid, treating the cosmic rays as test particles and considering the scattering centers as being frozen into the fluid. In this situation, the steady-state transport equation can be solved by expanding the distribution function in eigenfunctions of a second order differential operator, the eigenvalues of which determine the spatial dependence of the particle distribution. The eigenfunctions are readily calculated by solving an algebraic eigenvalue problem and can be cast as a series in Legendre polynomials. In this way, one can construct the general solution of the transport equation on either side of the shock, which has the correct behavior far away from the shock.

800,053
PB88-228184 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Cosmic-Ray Transport in Accelerating Flows.

Final rept.,
J. G. Kirk, R. Schlickeiser, and P. Schneider. 1988, 6p
Pub. in *Astrophysical Jnl.* 328, n1 p269-274, 1 May 88.

Keywords: *Cosmic rays, Synchrotron radiation, Reprints, Relativistic particles.

The quasi-linear transport equation of energetic charged particles is derived, including scattering by Alfvén waves propagating parallel and antiparallel to a uniform magnetic field, losses by synchrotron radiation, and acceleration of the cold background fluid supporting the waves. As in the comoving frame equations of radiative transfer, scattering, and loss terms are evaluated in the frame in which the fluid is locally at rest. The diffusion approximation is applied to the resulting equation, yielding a transport equation for the isotropic part of the distribution function and a first-order approximation to the anisotropy. The conditions under which this approximation may be applied are discussed. In the nonrelativistic regime, the standard equation of the diffusion approximation is recovered. As well as contributions previously investigated, new effects appear from the spatial and temporal variations of the fluid velocity as well as the synchrotron radiation terms. These are discussed in detail.

ATMOSPHERIC SCIENCES

Aeronomy

800,054
PB88-228226 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Remeasurement of the Rate Constant and Branching Ratio for the N2(1+) + O Reaction.

Final rept.,
K. Knutsen, V. M. Bierbaum, and S. R. Leone. 1988, 4p
Grant AFOSR-84-0272
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in *Planetary and Space Science* 36, n3 p307-310 1988.

Keywords: *Thermosphere, Atmospheric models, Ion density(Concentration), Reprints, Nitrogen ions, Oxygen atoms, Branching ratio, Rate constants.

The rate constant and branching ratio for the thermospherically important $\text{N}_2(1+) + \text{O}$ reaction are remeasured in a flowing afterglow. The resulting rate constant of $1.8(+ \text{ or } - 0.7) \times 10^{-10}$ to the -10^{th} power cc/s and branching ratio of $\text{NO}(1+):\text{O}(1+) = 90(+ \text{ or } - 3):10(+ \text{ or } - 3)$ are in good agreement with earlier measurements. The implications of these results for atmospheric models are described.

BEHAVIOR & SOCIETY

Meteorological Instruments & Instrument Platforms

Meteorological Instruments & Instrument Platforms

800,055
PB88-246749

(Order as PB88-246707, PC A04)

Missouri Univ.-Rolla.
Condensation Method for Humidity Measurement in the UMR (University of Missouri-Rolla) Cloud Simulation Chamber.
D. E. Hagen, D. R. White, and D. J. Alofs. 17 Feb 88, 6p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v93 n4 p551-556 1988.

Keywords: Cloud chambers, Water vapor, Drops(Liquids), Aerosols, *Humidity measurement, Condensation.

The University of Missouri-Rolla has developed a cloud simulation facility for the study of various atmospheric cloud processes. The initial relative humidity of the air sample put into the cloud chamber is a key parameter in virtually any experiment and needs to be known accurately. The report describes how the cloud simulation chamber itself has been used as a condensation type hygrometer to calibrate the system's humidifier. Two distinct and physically different methods for inferring mixing ratio are used, one exploiting the sensitivity of aerosol activation to humidity, and the other exploiting the sensitivity of the rate of growth of cloud droplets to humidity. The two methods give agreement with each other to within a precision of one part per thousand in mixing ratio.

600573. Sponsored by John and Mary R. Markle Foundation, New York.

Keywords: *Elections, Accuracy, Date processing security, *Voting, *Vote-tallying, Computer applications, *Computer program integrity, Computer security, Data integrity.

Recommendations are provided to promote accuracy, integrity, and security in computerized vote-tallying, and to improve confidence in the results produced. The recommendations respond to identified problems, and concern software, hardware, operational procedures, and institutional changes. It is proposed that the concept of internal control, almost universally used to protect operations that produce priced goods or services, be adapted to vote-tallying, a non-priced service. For software, recommendations concern certification, assurance of logical correctness, and protection against contamination by hidden code. For hardware, recommendations concern accuracy of ballot reading, and design and certification of vote-tallying systems that do not use ballots. Improved pre-election testing and partial manual recounting of ballots are recommended operational procedures.

tensile strength. These hybrid cement-composites display improved resistance to catastrophic failure and to chemical degradation resulting from exposure to acid environments. During the dual-setting process they also are less sensitive to excessive hydration and, after curing, less subject to dehydration than glass-ionomer cements. When used as the base material for indirectly bonding resin-based composites to dentin via the glass-ionomer cement-composite laminate, or sandwich, technique, these new cements do not require prior etching or the use of intermediary bonding agents to achieve a satisfactory seal against microleakage.

800,060

PB88-230313

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Color Changes of Composites on Exposure to Various Energy Sources.

Final rept.,

G. M. Brauer. 1988, 5p

Sponsored by National Inst. of Dental Research, Bethesda, MD.

Pub. in Dental Materials 4, p55-59 1988.

Keywords: *Dental materials, *Colorfastness, *Radiation effects, *Radiation tests, Exposure, Compositions, Curing, Curing agents, Resins, Polymerization, Light sources, Reprints.

The color stability of composites, on exposure to irradiation (1) by a 150 klux xenon lamp, (2) a standard RS light source and (3) at elevated temperature at 60 C, in air or water and under different experimental conditions was determined for various times. Composites studied included chemically and light cured hybrid and microfilled resins and a material copolymerized by light and chemical aftercure. Visible light cured materials studied were more color stable than 2 common chemically cured composites. Light shades yielded more visible color changes than dark shades of the same brand. There was a significantly more severe discoloration of composites kept in water at 60 C than for those stored in air. Comparison with results in 2 clinical studies of color changes, using 2 of the chemically cured composites investigated here, indicates that these 2 restoratives, which pass the ANSI/ADA or ISO specification tests, discolor in clinical use after 2-3 years.

800,061

PB88-238548

Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Partition Coefficient of Bovine Serum Albumin in Two-Phase Aqueous Systems.

Final rept.,

S. B. Sawant, J. B. Joshi, and S. K. Sikdar. 1988, 6p
Pub. in Biotechnology Techniques 2, n1 p41-46 1988.

Keywords: *Partition coefficients, Reprints, Bovine serum albumin, Aqueous systems.

The authors measured partition coefficients of bovine serum albumin in the following two-phase aqueous systems: polyethylene glycol-dextran and polyethylene glycol-potassium phosphate. The authors report the effects on partition coefficients of variables such as relative molecular masses of polyethylene glycol and dextran, phase composition and temperature.

800,062

PB89-101711

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Pulp Responses to a Dentin and Enamel Adhesive Bonding Procedure.

Final rept.,

H. R. Stanley, R. L. Bowen, and E. N. Cobb. 1988,

7p

Sponsored by American Dental Association Health Foundation, Chicago, IL.

Pub. in Operative Dentistry 13, p107-113 1988.

Keywords: *Dental materials, *Adhesive bonding, Dentin, Enamels, Adhesion tests, Composite materials, Toxicity, Reprints.

The study evaluated the pulp biocompatibility of a procedure for bonding composites to dentin and enamel with and without retention form in the teeth. All restorations were retained for seven or 21 days, except one where the preparation was contaminated before the composite was placed. Pathological changes were

BIOMEDICAL TECHNOLOGY & HUMAN FACTORS ENGINEERING

Biomedical Instrumentation & Bioengineering

800,058

PB88-176458

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Characterization of Biological Macromolecules by Electrophoresis and Neutron Activation.

Final rept.,

S. F. Stone, D. Hancock, and R. Zeisler. 1987, 14p

Pub. in Jnl. of Radioanalytical and Nuclear Chemistry 112, n1 p95-108 1987.

Keywords: *Autoradiography, *Biotechnology, *Electrophoresis, Reprints, Instrumental neutron activation analysis, Metalloprotein, Polyacrylamide, Trace element analysis.

As analytical techniques have become more sensitive, the role of trace elements associated with biological macromolecules has become the subject of many studies in the past twenty years. Many biologically significant macromolecules, such as nucleic acids and proteins, have trace elements essential to their function and structure. Instrumental neutron activation analysis (INAA) contributes useful information in such studies. A procedure combining polyacrylamide gel electrophoresis (PAGE) with INAA and autoradiography has been developed to study biological macromolecules and their associated trace elements. Results from the application of the method to several metalloproteins are presented.

800,059

PB88-198072

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Toughened Glass-Ionomer Cements.

Final rept.,

J. Antonucci. 1988, 1p

Pub. in Trends and Techniques 5, n3-4 Apr 88.

Keywords: *Dental materials, Composite materials, Reprints, *Glass ionomer cements, Biomaterials.

The feasibility of developing hybrid dental cement-composites from polyelectrolyte-based cements, e.g. glass-ionomer cements, using compatible polymers and/or free radical polymerizable vinyl monomers has been demonstrated. The resulting resin-modified cements exhibit a significant improvement in diametral

BEHAVIOR & SOCIETY

Psychology

800,056
PB88-189576

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.

Analytical Visual Clarity Experiment.

Final rept.,

J. A. Worthey. 1985, 13p

Pub. in Jnl. of the Illuminating Engineering Society 15, n1 p239-251 1985.

Keywords: *Visual perception, *Color vision, Fluorescent lamps, Illuminance, Experiments, Reprints.

When lights that differ in spectral composition illuminate similar colorful scenes, observers agree that one light may give the scene greater 'visual clarity' than another light. The original experiments to demonstrate this did not make clear the cause-and-effect relationship involved. In an earlier theoretical study, Worthey found that light sources differ in their ability to reveal red-green contrasts, and suggested that higher red-green contrasts yield higher 'clarity.' This inference exploits a body of data which show that red-green contrast contributes to the distinctness of borders. The present paper reports a simplified visual clarity experiment which validates this explanation. Several phenomena which occurred together in earlier clarity experiments were demonstrated separately.

General

800,057
PB89-114136

PC A07/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD.

Computer Science and Technology: Accuracy, Integrity, and Security in Computerized Vote-Tallying.

Special pub. (Final).

R. G. Saltman. Aug 88, 146p NBS/SP-500/158

Also available from Supt. of Docs. as SN003-003-02883-5. Library of Congress catalog card no. 88-

minimal, despite small dentin thicknesses which remained. Superficial and deep pulp responses included specimens with deep cavities, two of which were almost exposures.

800,063
PB89-101760 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Adhesive Bonding of Various Materials to Hard Tooth Tissues, XXX. Complexes of Iron Cations with N-phenylglycinate or Oxalic-Acid.

Final rept.,
R. L. Bowen, and D. N. Misra. 1986, 5p
See also PB83-143685. Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 65, n3 p412-416 1986.

Keywords: *Dental materials, *Adhesive bonding, Chelation, Dentin, Enamels, Adhesion tests, Chemical reactions, Reprints.

An improved method for adhesive bonding of composite restorative materials to human dentin and enamel recently has been developed. In this, a treatment of the surface with ferric oxalate is followed by the application of N-phenylglycine or its derivatives. The present study utilized Job's method of continuous variations together with freezing point osmometry to verify that complexes can form between N-phenylglycinate and iron cations. The observed data are in accord with the expectation that ferric ions tend to form complexes with six ligand-donor groups in aqueous solution under ordinary conditions. The data also indicated that ferric ions in aqueous solution probably form mixed complexes with oxalate and N-phenylglycinate. Ferric and ferrous ions formed brown N-phenylglycinate complexes.

800,064
PB89-107056 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Elastic Properties of Glass Reinforced Dental Composites.

Final rept.,
S. Singh, J. L. Katz, J. Antonucci, R. W. Penn, and J. A. Tesk. 1988, 5p
Pub. in Jnl. of Non-Crystalline Solids 102, p112-116 1988.

Keywords: *Dental materials, Elastic properties, Composite materials, Polymers, Reinforced plastics, Ultrasonic tests, Reprints.

Enamel and dentin are materials of complex structure. To replace the lost part of a functionally damaged tooth requires materials which have similar esthetics and physicochemical properties. The elastic properties of the materials are considered to be especially important in this regard. In the present study, the elastic properties of a pure dental resin and two glass-reinforced resin dental composites have been measured using ultrasonic propagation techniques. The ultrasonic pulse-through transmission method was used to measure both shear and longitudinal (dilatational) velocities. Density was measured using a buoyant force method. The Young's, shear and bulk moduli and Poisson's ratio were determined. The materials studied had Young's moduli of the order of 5-20 GPa. The use of a chemical coupling agent apparently did not significantly affect the elastic properties of these resin-based composites.

800,065
PB89-132955 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Ultrasonic Measurements of the Elastic Properties of Dental Materials.

Final rept.,
S. Singh, J. L. Katz, J. M. Antonucci, R. W. Penn, and J. A. Tesk. 1988, 1p
Grant PHS-DE-07054-10S1
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Proceedings of Third World Biomaterials Congress, Kyoto, Japan, April 21-25, 1988, p118.

Keywords: *Dynamic modulus of elasticity, *Composite materials, *Reinforced plastics, *Metals, Poisson ratio, Glass fibers, Dental materials, Ultrasonic tests.

Dynamic elastic moduli were measured for three non-precious dental alloys, two experimental glass filled-resin based dental composites, and the neat resin

used to make the composites. Poisson's ratios were calculated from the moduli. Poisson's ratio was not significantly different between unsilanized and silanized (coupled) glass reinforced composites. The elastic moduli of the alloys are at least one order of magnitude higher than the composites.

800,066
PB89-132963 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Transient and Residual Stress in Dental Porcelain Fused-to-Metal Restorations as Affected by the Thermal Expansion Coefficients of the Alloys.

Final rept.,
K. Asaoka, and J. A. Tesk. 1988, 1p
Pub. in Proceedings of Third World Biomaterials Congress, Kyoto, Japan, April 21-25, 1988, p518.

Keywords: *Dental materials, *Stress tests, *Computerized simulation, *Composite materials, *Porcelain, *Thermal expansion, Metals, Bonding, Ceramics, Dimensional stability, Glass transition temperature, Cooling.

A computer simulation of the development of thermo-mechanical stress in dental ceramic-metal systems is described. The effects of temperature dependent elastic moduli, shear viscosity (porcelain), and thermal expansion of the materials are included as are the temperature distribution and change of glass transition temperature, $T(\text{sub } g)$, (porcelain) during cooling. Results show that transient stress is most affected by (1) cooling rate (2) thermal expansion between $T(\text{sub } g)$ and the sag point (porcelain). Residual Stress is affected mostly by thermal expansion below $T(\text{sub } g)$. Qualitative agreement is obtained for shape change on other materials reported in the literature.

800,067
PB89-133003 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Dental Composites: Strength Properties via Weibull Statistics.

Final rept.,
W. G. de Rijk, R. W. Penn, J. A. Tesk, and L. J. Zapas. 1988, 1p
Pub. in Proceedings of Third World Biomaterials Congress, Kyoto, Japan, April 21-25, 1988, p251.

Keywords: *Dental materials, *Strength, *Acid resistance tests, *Weibull density functions, *Failure, Composite materials, Polymers, Bursting, Statistical analysis, Defects, Surface properties.

Strength properties of dental composite resins have been evaluated assuming a Weibull distribution. The results of a chemical degradation study show a mixed Weibull failure distribution. The results of a study on surface flaws show the validity of the Weibull risk of rupture equation for a conventional composite but not for the microfilled composites.

Bionics & Artificial Intelligence

800,068
PB88-181847 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.

Enhanced Telemannipulator Operation Using a Passive Vision System.

Final rept.,
D. R. Myers, M. Juberts, and S. A. Leake. 1985, 5p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Conference of Cybernetics and Society, Tucson, AZ., November 12-15, 1985, p802-806.

Keywords: Reprints, *Passive vision systems, *Telemannipulator operations.

No abstract available.

800,069
PB88-189287 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.

Process Reasoning.

Final rept.,
S. R. Ray. 1987, 7p
Pub. in Computers in Industry 9, n4 p329-335 Dec 87.

Keywords: Automation, Control, Hierarchical, Manufacturing, Planning, Reasoning, Work element, Reprints, *Artificial intelligence, *Automated machines, *Expert systems, *Process planning.

With the increasing levels of automation in factories, production management systems will need to incorporate intelligent entities which can model the behavior of manufacturing processes. An approach is presented for the design and implementation of process reasoning modules which characterize processes within a manufacturing environment. Each reasoning module must describe a process in terms of its effects, constraints, and process parameters. The effects include intended objectives, such as material transformation and also side effects such as burr production. Constraints include specific limits on process parameters, and preconditions to the invocation of a process. These preconditions could require the execution of several other processes, leading to the chaining of events. The process parameters provide qualitative and quantitative information necessary to execute a process. To implement a reasoning module, a process is classified in terms of the underlying physics taking place. This immediately generates a number of effects, and possibly some necessary process parameters to be associated with the process. The approach relies heavily on concepts of object-oriented programming, and artificial intelligence techniques. Thus, if a process operated on the principle of abrasion, all the implications of abras processing would be inherited. If one of the effects were a change in geometry, an interface to a geometry modeling system would also be inherited.

Prosthetics & Mechanical Organs

800,070
PB88-218177 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Summary of Conference on Design of Dental Prostheses.

Final rept.,
J. A. Tesk, and K. Anusavice. 1988, 2p
Pub. in Dental Materials 4, n2 p49-50 1988.

Keywords: *Dental prostheses, Design, Fabrication, Fracture strength, Reliability, Stress analysis, Finite element analysis, Reprints, Computer aided design, Computer aided manufacturing.

On July 12-17, 1987, a unique dental conference, entitled 'The Applications of Modern Engineering Methods to the Design and Fabrication of Dental Prostheses and Restorations' was held. The objective of the conference was to foster an interchange of ideas among dental researchers, engineers, academicians, and representatives from industry on how recent engineering methods could be applied to advance dental research related to the design and construction of dental prostheses and restorations. Sessions were held on finite element analysis (FEA), computer-aided design and computer-aided manufacturing (CAD/CAM), Weibull statistics, fracture mechanics, and reliability analysis. The unifying theme was the utilization of existing analytical solutions and software to analyze stress states and optimum design configurations in dental prostheses such that the risk of premature failure could be ascertained.

800,071
PB89-119176 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Calcium Phosphate Materials: Reactor Response.

Final rept.,
L. C. Chow. 1988, 4p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Advances in Dental Research 2, n1 p181-184 Aug 88.

Keywords: *Calcium phosphates, *Biocompatible materials, *Dental materials, *Bones, Dental cements, Reprints, *Implants.

The paper provides information supplementing the discussions and conclusions given in the paper presented by Dr. R. Z. LeGeros. Some of the advantages and limitations of calcium phosphate materials as bone implants were discussed. Properties and potential appli-

BIOMEDICAL TECHNOLOGY & HUMAN FACTORS ENGINEERING

Prosthetics & Mechanical Organs

cations of a new calcium phosphate setting cement were described.

800,072

PB89-123293

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Effect of Surface Preparation on Metal/Bone Cement Interfacial Strength.

Final rept.,

K. J. Bundy, and R. W. Penn. 1987, 33p

Pub. in Jnl. of Biomedical Materials Research 21, n6 p773-805 1987.

Keywords: *Metals, *Joint prosthesis, *Biocompatible materials, *Bone cements, Surface properties, Reprints.

The study is concerned with finding practical ways for strengthening metal/bone cement (M/BC) interfaces via surface alterations and identifying fundamental mechanisms underlying M/BC adherence. The variables examined with regard to their effects on interfacial strength are substrate material, surface roughness, interface porosity, passivation and sterilization, surface cleaning procedures, and use of bone cement precoated metals. M/BC interfaces can be substantially strengthened by applying the bone cement to the metal with high pressure. Roughened surface, as expected, produce stronger interfaces. Dramatic strength improvements occurred with a porous arc plasma sprayed layer on the substrate. Surprisingly, highly polished surfaces also improve interface strength. The hypothesis is advanced that M/BC adherence depends upon superposition of mechanical interlocking and atomic interaction effects, with the latter predominating for finer finishes and vice versa.

800,073

PB89-126908

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.

NBS (National Bureau of Standards) Hearing Aid Test Procedures and Test Data.

Final rept.,

E. D. Burnett, D. J. Evans, and T. W. Bartel. 1985, 163p

Sponsored by Veterans Administration, Washington, DC.

Pub. in Handbook of Hearing Aid Measurement, p7-169 1985.

Keywords: *Hearing aids, Sound pressure, Distortion, Frequency response, Tests, Methodology, Reprints.

The method used by NBS to test hearing aids for the VA is described. A brief description is given of various types of frequency responses, and a full description is given for determining the insertion response and related quantities. The various tests determining the properties of 'regular' and 'special-purpose' hearing aids are described.

a heat flux of 84 kW/sq. m. (2 cal/sq. cm.s) is applied to its outside surface for a minimum of 17.5 seconds (thermal protective performance (TPP) of 35). The results imply that fire fighters have only ten seconds or less to escape under most flashover conditions. However, the turnout coats provide good protection in many other fire situations. Practical definitions for flashover are given, and possible means for making the TPP test more relevant for research and development work are discussed.

General

800,075

PATENT-4 765 750

Not available NTIS
Department of Commerce, Washington, DC.

Method of Determining Subsurface Property Value Gradient.

Patent.

H. N. G. Wadley. Filed 26 Mar 87, patented 23 Aug 88, 4p PB88-250998, PAT-APPL-7-031 716

Supersedes PB87-189171.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Patents, *Temperature gradients, Subsurface investigations, Measurement.

A method for determining a subsurface property value gradient of a body includes the step of generating a Rayleigh wave in the body by passing a current through a first meander coil having predetermined spaced wires determining a wavelength of the generated Rayleigh wave. A second meander coil identical to the first meander coil is spaced at a predetermined distance from the first meander coil. The Rayleigh wave is then detected with the second meander coil and the velocity of the Rayleigh wave is determined. A property value of the body is determined at a depth determined by the wave-length of the Rayleigh wave which property value is a function of the determined velocity. The above steps are then repeated with at least one other pair of first and second meander coils having different predetermined spaced wires such that at least one second property value at a second depth is determined and a subsurface property value gradient is produced. Preferably, the pairs of meander coils are mounted to respective identical bases such that the distance between respective pairs of first and second coils is the same for all of the pairs of first and second coils. In addition, the property values determined are preferably temperatures, and the step of initially determining a modulus versus temperature profile for a material of the body is performed.

field surveys of existing lighting installations were recorded, the present study extends the data to include referencable lighting power densities for the original conditions. In addition, theoretical alternate ANSI lighting power densities are computed assuming one-for-one replacement with either energy saving or standard lamps and ballasts.

800,077

PB88-170006

PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.

Experimental Plan for Investigation of Lighting and HVAC Interactions.

S. J. Treado. Feb 88, 48p NBSIR-87/3656

Contract DE-A1D1-76PR06010

Sponsored by Department of Energy, Washington, DC.

Keywords: *Space HVAC systems, *Lighting systems, *Interactions, Buildings, Heat transfer, Test facilities.

The report describes the experimental plan for the investigation of the interaction of lighting and HVAC systems, including the purpose and scope of the research, the test facility and instrumentation system, and the data collection and analysis procedures. The research focuses on the relationship between lighting system design and performance, room design, and HVAC system design for typical office-type construction. A test facility will be constructed and instrumented to enable variation of lighting room and HVAC design. Testing will be performed for various configurations. The results will be used to develop design guidelines and modeling procedures, particularly for incorporation into building energy analysis computer programs.

800,078

PB88-175351

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.

Measurement of Moisture Content for Building Interior Surfaces.

Final rept.,

T. Kusuda, and M. Miki. 1985, 15p

Pub. in Proceedings of International Symposium on Moisture and Humidity 1985: Measurement and Control in Science and Industry, Washington, DC., April 15-18, 1985, p297-311.

Keywords: *Buildings, *Moisture, Humidity, Hygrometry, Reprints.

Knowledge of moisture absorbing and desorbing behavior of room surfaces is essential for predicting indoor humidity levels and latent heating/cooling requirements. The paper presents results of recent measurements conducted at the National Bureau of Standards to determine the moisture transfer dynamics of building room surfaces by the use of an infrared reflectance technique called the 'Quadra-Beam' method.

800,079

PB88-177688

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.

Measurement of Interzonal Heat and Mass Transfer by Natural Convection.

Final rept.,

B. M. Mahajan. 1987, 10p

Pub. in Solar Energy 38, n6 p437-446 1987.

Keywords: *Heat transfer, *Mass transfer, *Convection, Air flow, Temperature measurement, Reprints.

Experiments to measure the interzonal heat and mass transfer were carried out in two full size adjoining rooms under two different conditions. Before starting the tests, one of the rooms was heated to an average temperature of 32 C, while the other room was cooled to an average temperature of 19 C. To start the first type of tests, the auxiliary heating and cooling were turned off and the door blocking the opening opened. For the second test, auxiliary cooling was turned off, while the auxiliary heat was left on in the heated room. Visual observations of the flow phenomenon were made. Velocity and temperature profiles of the air-flow through the opening, and air temperatures in the test rooms were measured. The experimental mass and heat flow rates were computed from the velocity and temperature data and compared with the values predicted by the existing algorithms based on the application of the Bernoulli's equation.

BUILDING INDUSTRY TECHNOLOGY

Protective Equipment

800,074

PB88-200258

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Protecting Fire Fighters Exposed in Room Fires: Comparison of Results of Bench Scale Test for Thermal Protection and Conditions during Room Flashover.

Final rept.,

J. F. Krasny, J. A. Rockett, and D. Huang. 1988, 15p
Pub. in Fire Technology 24, n1 p5-19 Feb 88.

Keywords: *Fire fighters, Flashover, Heat flux, Thermal protection, Reprints, *Protective clothing, Turnout coats.

Heat flux conditions measured in seven room fires are discussed. The conditions varied from just below flashover in a sparsely furnished bedroom to flashover and severe postflashover fire in a typically furnished recreation room. These heat flux conditions are compared with the protection level provided by fire fighter turnout coats conforming to NFPA 1971, Protective Clothing for Structural Fire Fighting. This standard requires that the turnout coat or pants assembly must protect the wearer against second degree burns when

Architectural Design & Environmental Engineering

800,076

PB88-164512

PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.

Evaluating Office Lighting Environments: Reference Lighting Power Density Data.

G. Gillette. Jan 88, 61p NBSIR-88/3691

Prepared in cooperation with Lighting Research Inst., New York. Sponsored by National Electrical Mfrs. Association, Washington, DC. Lighting Equipment Div.

Keywords: *Office buildings, *Lighting equipment, Energy consumption, Energy conservation, Lamps, Ballasts(Electric).

The document reports on an exercise in archiving in situ lighting power densities for occupied office lighting environments. Drawing from a previous study where

800,080
PB88-189584 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Building Physics Div.
Calibration of the NBS (National Bureau of Standards) Calibrated Hot Box.
 Final rept.,
 R. Zarr, D. Burch, T. Faison, C. Arnold, and M.
 O'Connell. 1987, 11p
 Pub. in Jnl. of Testing and Evaluation 15, n3 p167-177
 1987.

Keywords: Residential buildings, Heat transfer, Reprints, *Hot boxes, *Calibration, Energy balance, Uncertainty, US NBS.

A series of calibration tests was conducted in the laboratory in order to determine the overall experimental error and uncertainty for the NBS calibrated hot box. For these tests, 4 in (0.1m) and 8 in (0.2m) thick polystyrene wall specimens having known thermal resistances were installed in a support frame and sandwiched between the climatic and metering chambers. The metering chamber was operated at a typical indoor condition for a residence, while the climate chamber was operated at selected steady outdoor winter conditions. For each of the tests, an energy balance was performed on the metering chamber. The residual for an energy balance of the metering chamber was compared to the predicted flanking loss determined using a finite-difference heat-transfer model. In addition, a special series of measurements was conducted to determine the accuracy of equipment used to measure the energy removed by the cooling coil of the metering chamber.

800,081
PB88-189592 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Building Physics Div.
Thermal Resistance Measurements of a Well-Insulated Wall Using a Calibrated Hot Box.
 Final rept.,
 R. R. Zarr, D. M. Burch, T. K. Faison, and C. E.
 Arnold. 1986, 22p
 Sponsored by Department of Energy, Washington, DC.
 Pub. in Jnl. of Thermal Insulation 10, p54-75 Jul 86.
 Keywords: *Walls, *Thermal resistance, Thermal insulation, Heat transfer, Reprints.

Thermal resistance measurements of a well-insulated residential wall are conducted using a calibrated hot box operated under a range of winter and summer climatic conditions. The wall consists of two insulated wood-frame sections with staggered framing. The measured thermal resistance is examined as a function of mean wall temperature and compared with predictions using the ASHRAE parallel-path method, the ASHRAE isothermal-plane method, and a temperature-dependent thermal conductivity finite-difference model. The effects of the compression of glass-fiber blanket insulation and nail penetrations on the overall thermal resistance are investigated.

800,082
PB88-194030 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Building Physics Div.
Accuracy in Pressurization Data Analysis.
 Final rept.,
 A. K. Persily, and R. A. Grot. 1985, 15p
 Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Transactions, v91 pt2B p105-119 1985.

Keywords: *Buildings, Pressurizing, Reprints, *Airtightness, Air infiltration.

Several different ratings of building airtightness are used to report the results of fan pressurization tests. These are generally based on airflow rates at specific reference pressures, predicted by curve fits to the test data. The statistical analysis used to obtain these curves allows estimates of the uncertainties associated with these calculated airtightness ratings. The accuracy of the various ratings of building airtightness are important issues in airtightness standards enforcement and the evaluation of retrofit effectiveness. In the paper the authors present the various airtightness ratings being used and discuss the uncertainties associated with these ratings due to measurement errors, fan calibration, and test conditions. The authors also apply standard statistical techniques to calculate confidence limits for the predicted airflow rates used in the airtightness ratings.

800,083
PB88-196787 Not available NTIS
 National Bureau of Standards (NEL), Washington, DC.
 Building Equipment Div.
Overview of HVACSIM(+), a Dynamic Building/HVAC/Control Systems Simulation Program.
 Final rept.,
 C. Park, D. R. Clark, G. E. Kelly, and J. Hirsch. 1985, 12p
 Sponsored by Department of Energy, Washington, DC.
 Building Services Div., and Civil Engineering Lab. (Navy), Port Hueneme, CA.
 Pub. in Proceedings of Annual Building Energy Simulation Conference (1st), Seattle, WA., August 21-22, 1985, p175-186.

Keywords: *Buildings, *Computerized simulation, Mathematical models, *Space HVAC systems, HVAC-SIM+ computer program.

In an effort to understand the dynamic interactions between a building shell, an HVAC system, and building controls, a non-proprietary building system simulation program called HVACSIM+, which stands for HVAC Simulation PLUS other systems, has been developed at the National Bureau of Standards (NBS). HVAC-SIM+ consists of a main simulation program, a library of HVAC system component models, a building shell model, and an interactive front end program. The main simulation program employs a hierarchical, modular approach and advanced equation solving techniques to perform dynamic simulations of building/HVAC/control systems. In the building shell model, a fixed time step, selected by the user, is employed, while a variable time step approach is used in the HVAC and control systems portion of a simulation. The paper presents the overall architecture of HVACSIM+, the main simulation program, numerical methods used, HVAC component models, the building shell model, and the results of a sample simulation.

800,084
PB88-201546 PC A03/MF A01
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Center for Building Technology.
Global Model for Building-Project Information: Analysis of Conceptual Structures.
 W. F. Danner. Apr 88, 45p NBSIR-88/3754

Keywords: *Building, Data, Information, Models, Conceptual modeling, Data modeling, Information modeling, Semantic modeling.

The development of a global model for building-project information requires a precise description of the meaning of the information to be maintained. The report presents an analysis of the conceptual structures that are available to specify that meaning using an 'as-designed' global model as an example. The model is currently under development by the Architecture, Engineering, and Construction (AEC) Committee of the Initial Graphics Exchanges Specification (IGES)/Product Data Exchange Specification (PDES) Organization. The key conclusion of the analysis is that a core semantic vocabulary is needed. The core vocabulary derives from how meaning is expressed without regard for specific domains of information. Preliminary elements of such a core vocabulary are defined. Further, a means by which that core is extended to add necessary domain-specific semantics is presented. The analysis has identified those aspects of developing a global model for building-project information that should proceed in the context of a broad interdisciplinary effort to represent information and those that require extensive technical input from the building industry.

800,085
PB88-215470 PC A04/MF A01
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Building Environment Div.
Comparison of Direct Digital Control and Pneumatic Control Systems in a Large Office Building.
 S. T. Bushby, and G. E. Kelly. Mar 88, 56p NBSIR-88/3739
 See also PB84-178284.

Keywords: *Buildings, *Environmental engineering, Heating, Cooling, Algorithms, Computer programs, Fortran, Dry bulb temperature, *Energy management, *Energy conservation, Direct digital control.

A distributed, microprocessor based direct digital control (DDC) energy management and control system was developed and installed in an eleven story office

building in Gaithersburg, Maryland. Over a period of one year the performance of this system under various control strategies was investigated along with the performance of a conventional pneumatic control system. The quality of control and performance trends for the two control systems were compared. Overall, the DDC system was found to maintain better control of the supply air temperature and to follow reset schedules more closely than the pneumatic system. One air handling unit performed as well under pneumatic control as it did under DDC in maintaining a supply air setpoint, but it did not precisely follow the reset schedule. Each air handling unit was found to have different performance characteristics while under pneumatic control, but all units behaved essentially the same under DDC. The results indicate that a pneumatic system can perform as well as a DDC system but more effort is required to maintain system performance.

800,086
PB88-232855 PC A03/MF A01
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Center for Building Technology.
Revised Unitary Heat Pump Specification for Military Family Housing.
 W. Mulroy, S. Weber, and D. Didion. Jun 88, 49p
 NBSIR-88/3805
 Sponsored by Corps of Engineers, Washington, DC., Department of the Air Force, Washington, DC., and Naval Facilities Engineering Command, Alexandria, VA.

Keywords: *Heat pumps, Residential buildings, Military facilities, Equipment specifications, Heating equipment, Armed forces procurement.

The purpose of the report is to revise and update the unitary heat pump specifications developed in 1976 which addressed the requirements for performance, testing, rating, design, safety, serviceability and reliability for the system and components; and conformance conditions. The document is intended for guidance in military procurement and applies to hermetic electrically-driven vapor compression unitary heat pumps of the remote (split) and packaged (integral) types, the air-to-air and water-to-water classes, and sizes from 12,000 to 135,000 Btu/h for both heating and cooling functions. The report reflects changes in specifications such that the qualified units would be compatible with current available commercial products. It also addresses installation practices and offers a new life cycle costing criteria for competitive selection. It is written in the format of a draft specification.

800,087
PB88-238621 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Center for Building Technology.
Simplified Model for Predicting Cumulative Sensible Cooling Loads.
 Final rept.,
 D. M. Burch, A. H. Fanney, and B. A. Licitra. 1988, 22p
 Sponsored by Department of Energy, Washington, DC.
 Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Transactions, v94 pt2 22p 1988.

Keywords: *Buildings, *Environmental engineering, *Air conditioning, Computerized simulation, Forecasting, Temperature control, Reprints, *Cooling load.

The paper presents the development and use of a simplified model for predicting the cumulative sensible cooling load for a single-zone building. Cooling load predictions are compared to results obtained using the detailed Thermal Analysis Research Program (TARP), a sophisticated computer model previously developed at the National Bureau of Standards. Weekly sensible cooling loads, predicted by the simplified model, agreed to within 3 percent of the values predicted by TARP. The investigation described within the paper reveals that the effect of thermal mass could not be incorporated within a simplified model due to complex interactions between the structure of a building, furnishings within the building, and climatic conditions.

800,088
PB89-136295 PC A08/MF A01
 National Inst. of Standards and Technology (NEL),
 Gaithersburg, MD. Building Environment Div.

BUILDING INDUSTRY TECHNOLOGY

Architectural Design & Environmental Engineering

Interaction of Lighting, Heating and Cooling Systems in Buildings. Interim Report.
S. J. Treado, and J. W. Bean. Dec 88, 153p NISTIR-88/3860

Sponsored by Department of Energy, Washington, DC. Office of Buildings and Community Systems.

Keywords: *Lighting systems, *Buildings, *Cooling load, *Energy efficiency, Test facilities, Fluorescent lamps, Heat transmission, Lightness, Monitoring, Space HVAC systems, Peak load, Energy conservation, Electric utilities.

The effect of interactions between building lighting, heating and cooling systems on the energy performance of the lighting system and cooling loads is examined, based on detailed full-scale measurements and supporting computer simulations. A test facility was designed, constructed and operated to emulate an office space with recessed fluorescent lighting. The test facility was extensively instrumented to monitor lighting power, cooling load, surface and air temperatures, heat flows and light levels. 398 measured parameters were averaged and recorded every two minutes during testing. The interim report describes preliminary results from the research effort. The results showed that the lighting system can be constrained to operate at its most efficient level, if the fluorescent lamps are cooled sufficiently. A two-term exponential relation with four regression coefficients was found to fit the measured data well.

800,089

PB89-137681 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.

Rating of Mixed Split Residential Air Conditioners.
Final rept.,
P. A. Domanski. 1988, 11p

Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of Annual Symposium on Improving Building Energy Efficiency in Hot and Humid Climates (5th), Houston, TX., p11-11 Sep 88.

Keywords: *Air conditioners, *Ratings, Evaporators, Expansion cooling, Fans, Computation, Reprints.

A methodology is presented for rating the performance of mixed, split residential air conditioners. The method accounts for the impact on system performance of the indoor evaporator, expansion device and fan; three major components that are likely to be substituted for the matched components in a mixed system. The method allows calculation of capacity at 95 deg F rating point and seasonal energy efficiency ratio, SEER, without performing laboratory test of the complete system. Limitations of the procedure, present work, and anticipated improvements are also discussed.

800,090

PB89-141097 PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.

Tracer Gas Techniques for Studying Building Air Exchange.
A. K. Persily. Feb 88, 39p NBSIR-88/3708

Keywords: *Air flow, *Buildings, Ventilation, Measurement, Fluid infiltration, Performance evaluation, Tracer gas.

A variety of procedures have been developed that employ tracer gases to examine the air exchange characteristics of buildings. These procedures enable the examination of several features of building air exchange including ventilation rates, air movement within buildings, and building envelope airtightness. The paper reviews tracer gas measurement techniques that have been used to study air exchange in buildings. Background information is discussed such as the instrumentation used in these tests, building features that influence their application, and the fundamental theory of tracer gas measurement. Several specific applications are discussed including air exchange rate measurement in large buildings, low-cost procedures for measuring air exchange rates in large numbers of buildings, techniques for evaluating the performance of air distribution systems, and pressurization testing of envelope airtightness in large buildings. A detailed bibliography is also included to facilitate a more thorough examination of the topics discussed.

Building Equipment, Furnishings, & Maintenance

800,091

PB88-169982 PC A10/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Effect of Cigarette Characteristics on the Ignition of Soft Furnishings.

Technical note (Final),
R. G. Gann, R. H. Harris, J. F. Krasny, R. S. Levine, H. E. Miller, and T. J. Ohlemiller. Jan 88, 217p NBS/TN-1241

Also available from Supt. of Docs. as SN003-003-02846-1.

Keywords: *Ignition, *Furniture, *Upholstery, Combustion, Flammability testing, Bedding equipment, *Cigarette smoking.

The research was performed by the NBS Center for Fire Research under the Cigarette Safety Act of 1984. Cigarette-initiated furniture fires are the leading cause of fire deaths and injuries in the United States. The objectives of the project was to determine those properties of cigarettes that have an impact on their ignition of furniture. Experiments were performed on small-scale representations of furniture as well as actual chairs. Experimental cigarettes, varied parametrically in six different characteristics, were used, along with some patented ('fire-safe') and representative commercial cigarettes. These experiments demonstrated significant differences in performance among the cigarettes used and led to further understanding of the features of the burning process that affect energy transfer to (and subsequent ignition of) furniture. Four cigarette characteristics were found to reduce ignition propensity: filter tip; low tobacco density; reduced circumference; and low paper permeability.

800,092

PB88-177654 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.

Thermal Performance Comparisons for Solar Hot Water Systems Subjected to Various Collector and Heat Exchanger Flow Rates.

Final rept.,
A. H. Fanney, and S. A. Klein. 1988, 11p
See also PB85-207173. Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.
Pub. in Solar Energy 40, n1 p11-11 1988.

Keywords: Hot water heating, Thermal efficiency, Performance, Reprints, *Solar water heaters.

The thermal performance of solar domestic hot water (SDHW) systems is influenced by the rate at which heat transfer fluids within the system are circulated. An experimental investigation has been conducted at the National Bureau of Standards to quantitatively evaluate the influence of flow rates, both for SDHW systems that circulate potable water directly through the solar collector array and for systems that employ an external heat exchanger to transfer heat from the solar collector array to the potable water. The article presents data from side-by-side experiments that shows improvements in overall SDHW system performance as a result of lowering the collector fluid flow rate for direct systems utilizing conventional return tubes. Although they are limited to one location, specific system configurations, and time periods, these experimental results support the general conclusions reached in earlier experimental and simulation studies regarding the advantage of reduced collector flow rates. Side-by-side experiments were also performed for SDHW systems in which the tanks were fitted with return tubes designed to reduce internal tank fluid mixing. The results of these experiments show only a small difference in overall performance for the systems operated at conventional and reduced collector flow rates. Side-by-side tests of an indirect SDHW system that employs an external heat exchanger did not show improved performance at reduced tank-side flow rates. A simulation study of an indirect SDHW for a range of heat exchanger designs and collector and tank-side capacitance rates concluded that an optimum collector-side capacitance rate does not exist and an optimum tank-side capacitance rate occurs only for heat exchangers with overall heat transfer coefficients much larger than that used in the experiments.

800,093

PB88-181953 PC A03/MF A01

Rutgers - The State Univ., New Brunswick, NJ.
Heat Transfer from a Negatively Buoyant Wall Jet.
Annual rept.,
K. Kapoor, and Y. Jaluria. Feb 88, 46p NBS/GCR-88/541
Contract NB83-NADA-4047
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Heat transfer, *Fires, *Buildings, Mathematical models, Plumes, Walls, Convection.

An experimental investigation has been carried out on the heat transfer characteristics of a turbulent, negatively buoyant, two-dimensional wall jet. A jet of hot air is discharged adjacent to a water-cooled, isothermal surface in an extensive environment. The heat transfer to the surface from the elevated-temperature jet is measured along the isothermal surface for several values of wall, jet and ambient temperatures. Wide ranges of Grashof number, Gr and Reynolds number, Re, are investigated. The total heat transfer to the isothermal surface is obtained.

800,094

PB88-183959 PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Comparisons of NBS/Harvard VI Simulations and Full-Scale, Multi-Room Fire Test Data.
J. A. Rockett, M. Morita, and L. Y. Cooper. Jul 87, 67p NBSIR-87/3567
See also PB84-226471.

Keywords: *Fire models, Simulation, Validation, *Compartment fires, Full scale compartment fire experiments, Multi-room fires.

The NBS/Harvard VI multiroom fire model computer code was used to simulate results of previously reported full-scale, multi-room fire experiments. The tests and simulations involved: four different compartment configurations made up of two or three rooms connected by open doorways, four different fire types generated by a methane burner located in the room identified as the burn room and up to four different doorway openings between the burn room and the adjacent space. A total of nineteen different tests were carried out and simulated. Comparisons between simulated and measured parameters of the fire-generated environments are reviewed. While the computer code is generally found to provide excellent simulations for the entire range of tests, several areas in modeling detail are identified as requiring clarification, research, and further improvement. The improvements should be incorporated in future versions of the NBS/Harvard Multi-Room Fire Model.

800,095

PB88-192414 PC A05/MF A01
Dayton Univ., OH. Research Inst.

Improved Furniture Fire Model within 'FAST' HEM-FAST-2.

Interim technical rept.,
M. A. DiTenberger. Mar 88, 84p UDR-TR-87-135,
NBS/GCR-88/545
Grant N648-SD0557
See also PB85-137685. Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fires, *Furniture, Mathematical models, Burning rate, Numerical analysis, Combustion products, Heat transfer, Soot, Calorimeters, Houses, Buildings, HEMFAST computer program.

The current research concentrated on some areas of improvement in the HEMFAST code with the goal of quantitative furniture fire predictions. The bench scale data processing routines is revised to take advantage of the recent upgrades in the cone calorimeter apparatus and of the consequential new scaling relationships for the materials burning rates and combustion products. The prediction accuracy of the furniture fire modules is improved by restructuring the code for better time integration of virgin surface temperature, flame front positions, and local burn history. Other improvements include a model of convective heat transfer on burning areas and a new soot formation model. A theoretical relationship between the specific soot extinction area exiting the flame and the flaming soot absorption coefficient was developed and partially validated. The cone calorimeter database of several furniture materials was processed into a form that can be used by the furniture fire modules for arbitrary sized fires.

Building Equipment, Furnishings, & Maintenance

800,096
PB88-192448 PC A03/MF A01
 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Automated Maintenance Management Program. Part 1: Quantitative Assessment of the Exterior Condition of Metal Buildings and Roofing Systems via Computer Image Processing.
 J. W. Martin, D. P. Bentz, L. Kaetzel, and M. E. McKnight. Mar 88, 32p NBSIR-88/3719
 Sponsored by Tri-Services Building Materials Investigation Program Committee.

Keywords: *Maintenance management, *Management systems, Automation, Computer applications, Military facilities, Metal coatings, Roofing, Buildings, Degradation, Pattern recognition, *Image processing, Data base management.

Automation of a maintenance management program could result in considerable benefits in terms of time, money, and aesthetics to any facilities' maintenance program. An integrated system combining computerized condition assessment, database management, and expert systems could serve to automate the maintenance management process. One part of such a system, the use of computer image processing to quantitatively assess the exterior condition of buildings, is presented. Computer image processing hardware and software are reviewed and the special concerns present in applying image processing to condition assessment are addressed. Examples of the capability of image processing to quantify the degradation of coated surfaces and roofing systems are presented. Finally the integration of image processing into an overall automated maintenance management program is discussed.

800,097
PB88-215504 PC A03/MF A01
 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Analysis of the Influence of Piston Effect on Elevator Smoke Control.
 J. H. Klotz. Apr 88, 25p NBSIR-88/3751
 See also PB82-254814.

Keywords: *Fires, *Air circulation, *Smoke, Elevators(Lifts), Stairways, Pressurizing, Fire safety, Air flow, Differential pressure, Fortran, *Building fires, *Smoke control.

The paper is part of a joint project between the United States and Canada to evaluate the feasibility of using elevators for the evacuation of the handicapped during a fire. The transient pressures produced when an elevator car move in a shaft are a potential problem for elevator smoke control. Such piston effect can pull smoke into a normally pressurized elevator lobby. The paper presents an analysis of an elevator smoke control system emphasizing the influence of piston effect on system performance. For most elevators the problem can be overcome by designs that prevent smoke from being pulled into lobbies, and equations for the amount of pressurization air to accomplish this are developed for two arrangements of supply air outlets. Where this approach is not feasible, the methods of analysis presented in the paper can be used to determine smoke infiltration for a hazard analysis.

800,098
PB88-219571 PC A03/MF A01
 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Small Flame Ignitability and Flammability Behavior of Upholstered Furniture Materials.
 J. F. Krasny, and D. Huang. Jun 88, 25p NBSIR-88/3771

Keywords: *Fire resistant materials, *Upholstery, *Fire tests, Ignition, Furniture, Household fabrics, Flames, Calorimeters, Thermal radiation, Bunsen burners, Cone calorimeters.

Identical upholstered furniture fabric and padding specimens were exposed to four increasingly severe small flaming ignition sources and to a radiant source. The small ignition sources were partly patterned after Bunsen burner tests. For the radiant source, the Cone Calorimeter was used, and specimens were exposed to irradiances of 10 and 15 kilowatts per square meter. A wide range of ignition properties was found, depending on both the cover fabric and padding. The relationship between Cone Calorimeter and small scale ignition tests was generally as follows: Specimens, which,

when exposed in the Cone Calorimeter at 15 kilowatts per square meter irradiance, reached a heat release rate of 50 kilowatts per square meter in less than 60 seconds generally were ignited by the two smaller sources used. Conversely, specimens which reached this heat release rate in longer times generally had greater small flame ignition resistance. Suggestions are also made for further improvements in the design of small scale flaming ignition and Cone Calorimeter tests for specimens combining an upholstery fabric and a padding.

800,099
PB89-101646 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Use of Computer Fire Models for Analyzing Thermal Detector Spacing.
 Final rept.,
 D. W. Stroup, and D. D. Evans. 1988, 13p
 Pub. in Fire Safety Jnl. 14, p33-45 1988.

Keywords: *Fire detection systems, *Fire alarm systems, Fire hazards, Fire protection, Sprinkler systems, Mathematical models, Reaction time, Spacing, Reprints, *Heat detectors, US NBS.

The paper presents a methodology for evaluating heat detection systems installed in buildings. Previous work for use primarily in designing new thermal fire detection systems was used as a starting point. The previous work was enhanced and supplemented to make it more useful for evaluating existing systems. The resulting equations were programmed into a user-interactive computer program. The program is available in both BASIC and FORTRAN and will run on mainframes as well as personal computers. A modified version of the FORTRAN program was used to develop an extensive set of tables listing detector activation times for given building geometries, detector characteristics, and fire growth rates. These tables are useful for quick evaluation of alternative heat detector installations. Practical examples are used to illustrate the utility of the concepts presented in the tables and computer programs.

Building Standards & Codes

800,100
PB89-118848 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Structural Standards Activities: ACI, ASCE, ASTM, and NBS.
 Final rept.,
 J. H. Pielert. 1984, 2p
 Pub. in Code News, n2 p7-8 1984.

Keywords: *Engineering standards, *Building codes, Specifications, Structural design, Construction industry, Civil engineering.

The paper describes the importance of structural standard specifications, practice and test methods in addressing the nation's infrastructure issue. The status of current standards activities are included with emphasis on the ASCE Standards Committee on Condition Assessment of Existing Buildings.

800,101
PB89-123236 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Review of Preliminary Performance Criteria for Tensile and Tensile Fatigue Tests of Bituminous Roofing Membranes.
 Final rept.,
 H. W. Busching, W. J. Rossiter, and R. G. Mathey. 1987, 20p
 Pub. in Durability of Building Materials 4, n4 p323-342 Apr 87.

Keywords: *Bitumens, *Roofing, *Performance standards, Membranes, Tensile strength, Tension tests, Fatigue(Materials), Durability, Elastic properties, Brittle fracturing, Viscoelasticity, Strains, Reprints.

Alternative approaches are reviewed for revision of the NBS preliminary performance criteria for tensile strength and tensile fatigue strength of bituminous membrane roofing. Five approaches--elasticity theory,

brittle fracture, viscoelasticity theory, strain energy and finite element techniques--were considered. Their advantages and limitations were identified and use of the strain energy approach for both tensile strength and tensile fatigue strength was recommended.

800,102
PB89-131916 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
Report of Roof Inspection: Partial Delamination of Adhesive-Bonded Seams at an Army Facility.
 W. J. Rossiter, and J. F. Seiler. Nov 88, 43p NISTIR-88/3893
 Sponsored by Army Engineer District, Baltimore, MD.

Keywords: *Roofs, *Adhesive bonding, *Seams(Joints), Inspection, Military facilities, Performance evaluation, Surfaces, Rubber seals, Field tests, Flexural strength, Comparison, Contamination, Membranes.

The document was prepared at the request of U.S. Army Engineer District, Baltimore, to provide assistance in obtaining data on the delamination of seams of an EPDM roofing system at Fort Belvoir, Virginia. The investigation was beneficial to NIST, because it provided an opportunity to characterize adhesive-bonded seams in service and to obtain data relative to NIST laboratory research on the effect of surface contamination on seam performance. Seam specimens were taken from the roof and analyzed for peel strength and surface condition of the rubber. In addition, seams were prepared in the laboratory using the same brand name rubber/adhesive system to obtain peel-strength values for comparison with those measured for the field specimens. The results of the study indicated that the field specimens had low T-peel bond strengths in comparison to the strengths achieved by the laboratory-prepared seams.

Construction Management & Techniques

800,103
PB88-181961 PC A05/MF A01
 National Bureau of Standards, Gaithersburg, MD.
Procedures for Sprinkler Anchor Installation on Surfaces with Fireproofing Materials.
 R. G. Mathey, L. I. Knab, J. L. Gross, and J. A. Small. Feb 88, 76p NBSIR-87/3676
 Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Air pollution abatement, *Buildings, *Sprinklers, *Fire resistant materials, Installing, Anchors(Fasteners), Fibers, Concrete slabs, Tests, Asbestos, Encapsulating, Procedures, Indoor air pollution.

Procedures were developed for limiting the release of fibers from fireproofing material during sprinkler hanger anchor installation on steel deck/concrete floor slab surfaces. These procedures were needed by the General Services Administration (GSA) for installation of sprinkler systems in buildings having fireproofing containing asbestos. A prototype floor slab having spray-on friable mineral wool fireproofing was used in laboratory tests. The mineral wool fireproofing was used as a model system for fireproofing containing asbestos. The various combinations of mechanical anchoring procedures (use of drills or powder-actuated gun) and encapsulation procedures tested limited the fiber release to a range of values of 0.000 to 0.055 f/cc (fibers per cubic centimeter) as compared to a range of values of 0.26 to 0.82 f/cc for procedures without encapsulation. Encapsulation was shown to be effective as evidenced by much higher levels of fiber release during testing without encapsulation. Because there is no known correlation between the release of mineral wool fibers and asbestos fibers, it was recommended that the procedures developed be evaluated by GSA in buildings having fireproofing containing asbestos. An air sampling protocol was developed for use by GSA in evaluating the procedures in the field. Subsequently field tests were conducted by GSA. The laboratory and field studies provided GSA with an effective procedure, measurement method, and decision tool for installing sprinkler hanger anchors in steel deck/concrete floor slabs having fireproofing materials.

800,104
PB88-200316 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Center for Building Technology.
Computer Integrated Construction.
 Final rept.,
 R. N. Wright. 1988, 8p
 Pub. in IABSE Periodica 1, p17-24 Feb 88.

Keywords: *Buildings, Automation, Reprints, *Computer integrated construction, Computer aided design, Robotics.

Computer integrated construction denotes a system for the automatic exchange of information between participants and devices in the construction process throughout the project life cycle (design to construction to end use). A principal requirement is that open systems of software and hardware are needed by the nature of the U.S. construction industry for successful automation in the construction project.

Construction Materials, Components, & Equipment

800,105
PB88-169826 PC A04/MF A01
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Center for Building Technology.
Friability of Spray-Applied Fireproofing and Thermal Insulations: The Basis for a Field Test Method.
 W. J. Rossiter, W. E. Roberts, and R. G. Mathey.
 Dec 87, 59p NBSIR-87/3621
 Sponsored by General Services Administration, Washington, DC.

Keywords: *Asbestos, *Friability, Mechanical tests, Thermal insulation, Indoor air pollution, Risk, Fibers, Flameproofing, Field tests.

The investigation was Phase 1 of a two part study to develop a test method that can be used in the field to measure the friability of spray-applied fireproofing and insulating materials containing asbestos fibers. Four test methods were selected; compression/shear, indentation, abrasion, and impact. For each of the four tests, mechanical devices were devised by modification of existing material test apparatus. A description of the test devices is given in the report.

800,106
PB88-187711 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Building Materials Div.
Single-Ply Roofing--A Decade of Change.
 Final rept.,
 W. J. Rossiter. 1985, 4p
 Pub. in ASTM (American Society for Testing and Materials) Standardization News, p32-35 Sep 85.

Keywords: *Roofing, Reprints.

No abstract available.

800,107
PB88-189212 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Building Materials Div.
Weatherization of Residences: Criteria for Thermal Insulation.
 Final rept.,
 W. J. Rossiter, and R. G. Mathey. 1985, 16p
 See also PB84-241728.
 Pub. in Jnl. of Thermal Insulation 8, p298-313 Apr 85.

Keywords: *Weatherization, *Houses, *Materials, Criteria, Thermal insulation, Weatherproofing, Storm windows, Doors, Weatherstripping, Thermostats, Fire safety, Energy conservation, Reprints.

Criteria were developed for retrofit materials and products included in the DoE Weatherization Assistance Program. These materials and products were thermal insulation, storm windows and doors, replacement windows and doors, caulks and sealants, weatherstripping, vapor retarders, clock thermostats, and replacement glazing. The criteria were based on a consideration of factors such as thermal performance, fire safety, durability, quality, conformance to building codes, use, and ease of insulations. The paper presents the criteria for thermal insulations developed in

the study. The criteria are based on conformance to existing specifications and standards. Fire safety requirements for thermal insulations are recommended with regard to the use and locations where they are installed.

800,108
PB88-193875 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Fire Safety Technology Div.
Salt Water Modeling of Fire Induced Flows in a Multiroom Enclosure.
 Final rept.,
 K. D. Steckler, H. R. Baum, and J. G. Quintiere.
 1985, 4p
 See also PB86-196417. Sponsored by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.
 Pub. in Proceedings of Fall Technical Meeting on Chemical and Physical Processes in Combustion, Philadelphia, PA., November 4-6, 1985, p58.1-58.4.

Keywords: *Fires, *Model tests, Buildings, Air flow, Gas flow, Combustion products, Compartment fires.

Salt water modeling has been applied to study fire-induced flows in a multiroom structure. The form of physical modeling substitutes dyed salt water moving in fresh water for hot gas moving in a cold gas. Tests were conducted in an inverted 1/20 scale clear plastic model of an NBS full-scale fire test facility. Salt water results are shown to be in good agreement with fire test results previously obtained in the full-scale facility.

800,109
PB88-194055 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Building Equipment Div.
Field Measurement of Heat Flow Through Windows.
 Final rept.,
 M. E. McCabe. 1987, 8p
 Sponsored by Bonneville Power Administration, Portland, OR.
 Pub. in International Conference on Building Energy Management (ICBEM '87), Lausanne, Switzerland, September 30, 1987, p261-268.

Keywords: *Windows, *Heat flow, Performance evaluation, Heat transfer, Heat transmission, Energy conservation.

Estimation of the performance of such fenestration products as windows, glass patio doors, and skylights, particularly as they affect energy use in buildings, commonly involves the calculation of the rate of heat transfer using heat transfer data such as thermal transmittance (U-value). Manufacturers have usually tested their products in the laboratory at standard winter design conditions by one of the following hot box techniques: the AAMA test method (1), the ASTM C236 Guarded Hot Box method (2), or the ASTM C976 Calibrated Hot Box method (3). The differences and the similarities between each of these test methods have been described by Goss (4). Laboratory test results have shown the thermal performance of windows to have greater sensitivity to climatic variables such as air temperature and wind velocity than anticipated (5). Therefore, window manufacturers' performance data based on testing done at winter design conditions may not be directly applicable for estimating energy performance over a heating and/or cooling season. These concerns suggest that an alternative method for evaluating thermal performance of competing window designs is by long-term, side-by-side testing in the field, with controlled interior temperatures.

800,110
PB88-194063 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Building Materials Div.
Effect of Application Parameters on Adhesive-Bonded Seams in Single-Ply Membranes.
 Final rept.,
 W. J. Rossiter. 1985, 8p
 Pub. in Proceedings of International Symposium on Roofing Technology, Gaithersburg, MD., p383-390 Sep 85.

Keywords: *Adhesive bonding, *Membranes, *Roofing, Elastomers, Loads(Forces), Elongation, Shear properties, Strength, Tests, Seaming, Bonding.

Adhesive-bonded seams in commercially-available EPDM and neoprene roofing membrane materials were prepared under a variety of application conditions

to investigate the effects of the conditions on the resulting bond. Factors included in the study and considered to have possible effect on the adhesive-bond were lap length, surface contamination of the rubber, moisture, temperature, and voids in the lap. Lap shear specimens were tested in tension. The load and ultimate elongation at specimen failure were compared as related to the conditions under which the specimens were prepared or to the presence of voids in seam. The results indicated that in most cases the application conditions had little effect on the measured load and ultimate elongation of the test specimens. In particular, specimens with voids had, in many cases, values of load and ultimate elongations comparable to those of the control specimens. Based on the results, the adequacy of the lap shear test to detect possible differences in bond strength due to differences in the application conditions was questioned.

800,111
PB88-194089 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Building Materials Div.
Semi-Quantitative Condition Assessment of Paints and Substrate Surfaces.
 Final rept.,
 M. E. McKnight, R. G. Mathey, R. W. Drisko, and J. R. Neal. 1985, 15p
 Sponsored by Air Force Engineering and Services Center, Tyndall AFB, FL.
 Pub. in SSPC (Steel Structures Painting Council) Annual Symposium on Techniques for Long-Term Protection of Steel Structures, Atlanta, GA., February 26-27, 1986, p1-15 1985.

Keywords: *Protective coatings, *Paints, Substrates, *Building materials.

Protective coatings on buildings and other structures deteriorate over time. As the deterioration proceeds, the coating begins to fail to protect the substrate, leaving the substrate vulnerable to attack by the environment. Deterioration of the protective coating and/or the substrate ultimately necessitates maintenance. Selection of a cost-effective coating maintenance procedure for a structure requires an assessment of the condition of the coating and substrate surface. The paper describes a semi-quantitative approach to condition assessment of coatings and substrate surfaces. General factors that should be considered in developing assessment procedures are discussed, and a specific CA procedure for use on buildings with metal siding and roofing is described.

800,112
PB88-195151 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Structures Div.
Durability of Building Materials: Durability Research in the United States and the Influence of RILEM on Durability Research.
 Final rept.,
 J. R. Wright, and G. J. C. Frohnsdorff. 1984, 10p
 Pub. in Materials and Structures 18, n105 p205-214 1984.

Keywords: Durability, Reviews, Reprints, *Building materials.

The paper is based on the text of a talk given at a RILEM seminar on Durability of Building Materials. It reviews some of the recent non-proprietary research on the durability of building materials carried out in the U.S. It also reviews activities in RILEM which have stimulated the generation or dissemination of knowledge on durability of building materials. The paper emphasizes the need for international collaboration in durability research.

800,113
PB88-199641 PC A04/MF A01
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Center for Fire Research.
Fire Research Publications, 1987.
 N. H. Jason. Apr 88, 71p NBSIR-88/3758
 See also report for 1986, PB88-109889.

Keywords: *Fires, *Bibliographies, Combustion, Smoke, Toxicity, Plastics, Wood products, Mathematical models, Flammability, Fire safety, Fire prevention, Research, Cigarette smoking.

'Fire Research Publications, 1987' is a supplement to previous editions; the last five editions are as follows: 1982 - NBSIR 83-2706 - PB83-239015; 1983 - NBSIR

84-2871 - PB84-217066; 1984 - NBSIR 85-3153 - PB85-208502; 1985 - NBSIR 86-3372 - PB86-208317; 1986 - NBSIR 87-3555 - PB88-109889. Only publications prepared by members of the Center for Fire Research (CFR), by other National Bureau of Standards (NBS) personnel for CFR, or by external laboratories under contract or grant from the CFR are cited.

800,114
PB88-199724 PC A05/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Review of Autoclaved Aerated Concrete Products, R. G. Mathey, and W. J. Rossiter. Mar 88, 80p
NBSIR-87/3670
Sponsored by Department of Energy, Washington, DC.

Keywords: *Concretes, Autoclaving, Aeration, Manufacturing, Construction, Loads(Forces), Standards, Evaluation, Reviews, Requirements, Light weight concretes, Cellular concretes, Insulating concrete, Energy conservation.

The report is a review of the properties and performance of autoclaved aerated concrete. The material has a relatively low thermal conductivity combined with loadbearing capacity for use in structural and non-structural applications. This feature may make its use attractive for energy-conserving applications. The review addresses an overview of the manufacturing process, uses of autoclaved aerated concrete in building constructions, properties, energy considerations, the availability of code-related documents, and standards. Uses include block and panel construction in both loadbearing and non-loadbearing applications for walls, floors, and roofs. Many properties are reviewed including density, fire resistance, moisture expansion and shrinkage, strength, structure, and thermal conductivity.

800,115
PB88-201538 PC A06/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Experimental Data Set for the Accuracy Assessment of Room Fire Models, R. D. Peacock, S. Davis, and B. T. Lee. Apr 88, 121p
NBSIR-88/3752

Keywords: *Fires, *Buildings, Experimental data, Mass flow, Heat transmission, Mathematical models, Accuracy, Computer applications.

The development of experimental data for use in computer fire model accuracy assessment is described. The tests were conducted in a heavily instrumented structure to provide data on temperatures and mass and heat flows in a simple multi-room configuration. Several series of carefully designed experiments were carried out changing important physical parameters one at a time with several replicates of each configuration. The current state of understanding in computer fire model accuracy assessment is discussed with the data presented forming an example of one step of the process.

800,116
PB88-215454 PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Measurement of Droplet Size in Sprinkler Sprays, J. R. Lawson, W. D. Walton, and D. D. Evans. Feb 88, 52p
NBSIR-88/3715
Sponsored by Swedish Fire Research Board, Stockholm, and General Services Administration, Washington, DC.

Keywords: *Sprinkler systems, Droplets, Spraying, Water, Flow rate, Tests, Size, Fire safety, Research.

A computer-controlled video shadowgraph was used to collect data on the spray characteristics of a commercially available sprinkler head. A total of 15 tests were carried out that measured spray characteristics at different positions close to the sprinkler head. Tests were conducted using two different water flow rates, one and two liters per second. Droplet diameters were measured and analyzed to produce graphic presentations of normalized cumulative volume and cumulative number vs. droplet diameter data. In addition, a comparison was made between the droplet diameters measured using the video analyzer and droplet samples collected in a light oil and measured manually using a microscope. The data are also compared with results found in the literature.

800,117
PB88-215462 PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Estimating the Environment and the Response of Sprinkler Links in Compartment Fires with Draft Curtains and Fusible Link-Actuated Ceiling Vents. Part 1. Theory, L. Y. Cooper. Apr 88, 39p
NBSIR-88/3734
Sponsored by American Architectural Mfrs. Association, Des Plaines, IL.

Keywords: *Vents, *Fire protection, *Sprinkler systems, Mathematical models, Buildings, Equations, Plumes, Fluid dynamics, Fires, Smoke, Heat transfer.

The physical basis and associated mathematical model for estimating the fire-generated environment and the response of sprinkler links in well-ventilated, curtained compartment fires with fusible link-actuated ceiling vents is developed. Complete equations and assumptions are presented. Phenomena taken into account include: the flow dynamics of the upward-driven, buoyant fire plume; growth of the elevated-temperature smoke layer in the curtained compartment; the flow of smoke from the layer to the outside through open ceiling vents; the flow of smoke below curtain partitions to building spaces adjacent to the curtained space of fire origin; continuation of the fire plume in the upper layer; heat transfer to the ceiling surface and the thermal response of the ceiling as a function of radial distance from the point of plume-ceiling impingement; the velocity and temperature distribution of plume-driven near-ceiling flows and the response of near-ceiling-deployed fusible links as functions of distance below the ceiling and distance from plume-ceiling impingement.

800,118
PB88-215926 PC A23/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Proceedings of the Joint Panel Meeting (9th) of the UJNR Panel on Fire Research and Safety, N. H. Jason, and B. A. Houston. Apr 88, 548p
NBSIR-88/3753
See also N84-13341. Meeting Held at Norwood, Massachusetts, May 4-8, 1987.

Keywords: *Meetings, *Fire safety, United States, Japan, Combustion, Toxicity, Building materials, Fire hazards, Smoke, Sprinklers, Fire protection, Combustion products, Risk assessment.

The 9th Joint Panel Meeting of the United States-Japan Panel on Fire Research and Safety was held jointly with the Combustion Toxicity and 6th Expert Meeting of the U.S.-Japan-Canada Cooperative Research Group on Toxicity of Combustion Products from Building Materials and Interior Goods at the Factory Mutual Research Corporation, Norwood, MA. Technical sessions were in the areas of: Fire and Smoke Physics; Risk, Hazard and Evacuation; and Fire Toxicity and Evacuation. Progress reports were presented in each area, in addition to state-of-the-art papers.

800,119
PB88-225669 PC A10/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Review of Nondestructive Evaluation Methods Applicable to Construction Materials and Structures. Technical note (Final), R. G. Mathey, and J. R. Clifton. Jun 87, 205p
NBS/TN-1247
Also available from Supt. of Docs as SN003-003-02873-8. Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Nondestructive tests, *Construction materials, *Product inspection, *Buildings, Performance evaluation, Methodology, Specifications, Facilities management.

Nondestructive evaluation (NDE) methods for evaluating in situ construction materials and for condition assessment of building components and systems were identified and are described. The report is intended to help inspectors and those involved in condition assessment choose appropriate NDE methods for specific building materials, components, and systems. Important properties of building materials along with important performance requirements for building components are listed, and appropriate NDE methods for de-

termining these properties are recommended. In many cases the advantages and limitations of the NDE methods are presented. In a related aspect of the study, current Navy practices relative to the use of NDE methods in the construction and service cycle of buildings and other structures were reviewed. Navy Guide Specifications were examined for required tests, both NDE and destructive, of in situ building materials and components.

800,120
PB88-228325 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
Standards for Building Materials, Equipment, and Systems. Final rept., R. D. Dikkers. 1988, 2p
See also PB88-153739.
Pub. in American Jails II, n1 p36-37 1988.

Keywords: *Construction materials, *Prisons, Fire safety, Security, Standards, Performance, Reprints, *Building materials, *Jails, Test methods.

Because of equipment and system performance problems which have occurred in jails and prisons, the National Institute of Corrections (NIC), U.S. Department of Justice, initiated a study at the Center for Building Technology, National Bureau of Standards (NBS) in September 1986. The general objective of the study is to develop guidelines, test methods and the technical bases for standards which would assist in the selection, application, and maintenance of building materials, equipment and systems for use in detention and correctional facilities. During the first year of the study, the primary focus has been on determining the state-of-the-art in the design and construction of detention and correctional facilities. Specific emphasis was placed on identifying performance problems associated with various materials, equipment and systems, as well as reviewing available guidelines, standards, etc. which are or can be used by architects and correctional officials in the planning and design of new correctional facilities. Based on information presented, there are many important criteria and standards which need to be developed for improving the selection of materials, equipment and systems.

800,121
PB88-241054 PC A05/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Large-Scale Compartment Fire Toxicity Study: Comparison with Small-Scale Toxicity Test Results, E. Braun, B. C. Levin, M. Paabo, J. L. Gurman, H. M. Clark, and M. F. Yoklavick. Jul 88, 84p
NBSIR-88/3764
Sponsored by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Fire tests, *Toxicity, Upholstery, Polyurethanes, Foam, Cotton fabrics, Carbon monoxide, Hydrogen cyanide, Laboratory animals.

Ten large-scale single compartment fire tests were performed using two polyurethane foams and a cotton upholstery fabric. Animals were exposed to the products of decomposition of cushion assemblies burned under three different combustion modes: smoldering combustion; flaming combustion; and smoldering-to-flaming transition combustion. Comparison of gas yields (CO, CO₂, and HCN) between these tests and prior large- and small-scale tests showed that the CO and CO₂ yields agreed within a factor of 3, while the NBS Toxicity Protocol produced 10 times more HCN in the flaming mode and ramped heating mode than the large-scale tests. Model calculations showed that within-exposure animal deaths in small- and large-scale tests correlated with model values greater than 0.7. Burn room animal deaths could not be explained in terms of the four gases used in the N-gas model.

800,122
PB88-243381 PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Collapse of Masonry Wall under Construction in Pawtucket, Rhode Island, October 28, 1985, F. Y. Yokel. Jul 88, 50p
NBSIR-88-3820
Sponsored by Occupational Safety and Health Administration, Boston, MA. Office of Solicitor.

BUILDING INDUSTRY TECHNOLOGY

Construction Materials, Components, & Equipment

Keywords: *Concrete blocks, *Buildings, *Walls, Accident investigations, Pawtucket(Rhode Island), Masonry, Stability, Safety, Reviews, Wind pressure.

Results from a study to determine the cause of the October 28, 1985 collapse of a masonry wall under construction in Pawtucket, RI are presented. The wall was a 60 ft-3 in. long, 23 ft-6 in. high partially reinforced concrete masonry wall supported by wooden braces. The study included: inspection of construction plans and specifications; review of construction records and eyewitness accounts recorded immediately after the collapse, as well as testimony from OSHA inspectors and local building officials who visited the site a short time after the collapse; examination of photographs taken by OSHA inspectors and police investigators; analysis of meteorological data; and a stability analysis of the collapsed wall. It is concluded that the collapse was probably caused by a gust of wind which exerted lateral forces which exceeded the lateral-load capacity of the wall and its supporting wooden braces. Contributing factors were the lack of grout in the masonry cores which contained the steel reinforcement dowels and the inadequate anchoring of the dowels in the foundation.

800, 123

PB88-243399 PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD.

Technical and Economic Analysis of CFC-Blown Insulations and Substitutes for Residential and Commercial Construction.
S. R. Petersen, and A. H. Fanne. Jul 88, 63p
NBSIR-88/3829
Sponsored by Department of Energy, Washington, DC. Building Systems Div.

Keywords: *Thermal insulation, *Chlorine organic compounds, *Technology assessment, Economic analysis, Fire resistant materials, Building boards, Insulating boards, Construction materials, Energy conservation.

The thermal performance and economics of rigid foam insulating materials containing chlorofluorocarbons (CFC's) and alternative insulation materials that contain little or no CFC. Residential walls (wood-frame and masonry), commercial wall systems (frame, masonry, and curtain wall) and commercial low-slope roof systems are examined in a wide range of climates in the United States to determine the cost effectiveness of rigid foam insulation materials. Economic substitutes for insulation materials containing CFC exist; however, they are not compatible with all types of wall/window and roof systems and thus may make some wall and roof systems impractical.

800, 124

PB89-101356 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Impact-Echo Method: Detecting Honeycombing, the Depth of Surface-Opening Cracks, and Ungrouted Ducts.

Final rept.,
M. Sansalone, and N. J. Carino. 1988, 9p
Pub. in Concrete International: Design and Construction 10, n4 p38-46 Apr 88.

Keywords: *Concrete, *Honeycomb structures, *Non-destructive tests, *Ducts, *Crack propagation, Stress waves, Impact tests, Reprints, *Impact-echo methods, Finite element method.

The impact-echo method for nondestructive testing of concrete was successfully used to locate honeycombed concrete and an ungrouted metal duct and to determine the depth of vertical surface-opening cracks in concrete. The studies were carried out on laboratory specimens that contained artificial flaws at known locations. Frequency analysis of recorded surface displacement waveforms was used to determine the location of the various flaws. Finite element studies of the transient impact response of a solid containing simulated honeycombing were also carried out to gain an understanding of transient wave propagation through such a solid.

800, 125

PB89-101414 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Science and Engineering Div.

Development of a Method for Assessing Toxic Hazard.

Final rept.,
R. W. Bukowski. 1985, 6p
Pub. in Fire Jnl. 79, n2 p24-26, 28-29, 82 Mar 85.

Keywords: *Fire safety, *Toxicity, Fire protection, Flammability, Construction materials, Burning rate, Buildings, Combustion products, Reprints, *Air toxic substances.

The NBS toxic hazard assessment test model is capable of measuring the toxic hazard of a single burning item in a specific building or section of a building consisting of several compartments on a single floor. Subsequently, the model should be capable of predicting the spread and involvement of a number of items in the room of origin and be able to predict the spread of heat, gases, and smoke to several floors of a building. Further work on the model will include egress actions, the incapacitating and irritant effects of combustion products on occupants, and the impact of fixed fire protection systems. Ultimately, the model will provide a means of answering most questions they faced in the fire protection field.

800, 126

PB89-124879 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.

Trip Report: Japanese Progress in Robotics for Construction.

Final rept.,
J. S. Albus. 1986, 10p
Pub. in Robotics 2, n2 p103-112 Jun 86.

Keywords: *Construction equipment, Construction, Automation, Research, Research management, Japan, Reprints, *Robotics, Technology transfer.

The trip was part of a study mission sponsored by the Technology Transfer Institute, and co-sponsored by the Construction Robotics Laboratory at Carnegie Mellon University. The study mission visited six of the largest construction firms in Japan, a University, and a Robotics Research Association. Perhaps the most important finding is that all the major Japanese construction companies have large research budgets and impressive in-house research staff. Of the companies visited, all had research laboratories staffed with more than 200 people, and budgets in excess of \$10 million. These companies aggressively compete with each other in many areas of advanced technology, including construction robotics, and are actively transferring results from the research laboratory to the construction site.

800, 127

PB89-131924 PC A05/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

Frability of Spray-Applied Fireproofing and Thermal Insulations: Laboratory Evaluation of Prototype Test Devices.

W. J. Rossiter, W. E. Roberts, and R. G. Mathey.
Nov 88, 80p NISTIR-88/3848
See also PB88-169826. Sponsored by General Services Administration, Washington, DC.

Keywords: *Flameproofing, *Thermal insulation, Evaluation, Field tests, Abrasion, Impact tests, Compression tests, Shear tests, Asbestos, Construction materials.

The report describes the results of the second phase of a study to develop a field test method for assessing the friability of spray-applied fireproofing and thermal insulating materials. Phase 2 is the laboratory evaluation of the prototype devices for conducting surface and bulk compression/shear, indentation, abrasion, and impact tests. The results indicated that the surface and bulk compression/shear, indentation, and impact devices provided some measure of discrimination between samples subjectively judged as having 'high' and 'moderate' friability. In contrast, the abrasion device was non-discriminating in that, for all tests, a residue was produced. It was concluded that all devices be included in the field phase of the study using in-place spray-applied fireproofings having different levels of friability.

800, 128

PB89-132344 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

Suggested Research Topics for the Construction Engineering Research Laboratory (CERL) Program, Evaluation of Roofing Materials Degradation Processes.
W. J. Rossiter, and L. W. Masters. Nov 88, 30p
NISTIR-88/3870

Sponsored by Construction Engineering Research Lab. (Army), Champaign, IL.

Keywords: *Roofing, Degradation, Evaluation, Membranes, Performance, Life(Durability), Criteria, Quality assurance.

The document was prepared at the request of U.S. Army Construction Engineering Research Laboratory (CERL) to provide assistance in developing plans for conducting roofing research under its program entitled, 'Evaluation of Roofing Materials Degradation Processes'. Five areas of needed research dealing with service-life prediction of membrane performance were suggested. The suggestions are based on needs of the industry in the area of service-life prediction as described in the NIST research plan and the summary of the Round Table Seminar on Roofing Research. Although the research topics proposed cover the wide range of newer membrane products currently available in the U.S. industry, the link between the topics is that of service-life prediction and quality assurance. Completion of the studies recommended in the report would provide valuable information on membrane properties and predictive methodologies.

800, 129

PB89-132864 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Science and Engineering Div.

Estimating the Environment and the Response of Sprinkler Links in Compartment Fires with Draft Curtains and Fusible Link-Actuated Ceiling Vents: An Overview.

Final rept.,
L. Y. Cooper. 1988, 4p
See also PB88-215462. Sponsored by American Architectural Mfrs. Association, Des Plaines, IL.
Pub. in Proceedings of Joint Meeting of the UJNR (US-Japan Conference on Utilization of Natural Resources) Panel on Fire Research and Safety (10th), Tsukuba, Japan, June 9-10, 1988, p2-5.

Keywords: *Mathematical models, *Building codes, *Fire prevention, *Sprinkler systems, *Meetings, Ventilation, Ducts, Ceilings(Architecture), Flow distribution, Reprints.

A physical basis for estimating the fire-generated environment and the response of sprinkler links in well-ventilated compartment fires with draft curtains and fusible link-actuated ceiling vents is discussed. Phenomena taken into account include: growth of the smoke layer in the curtained compartment; the flow dynamics of the buoyant fire plume; the flow of smoke through open ceiling vents; the flow of smoke below draft curtains; continuation of the fire plume in the upper layer; heat transfer to the ceiling surface and the thermal response of the ceiling; the velocity and temperature distribution of plume-driven near-ceiling flows and the response of near-ceiling-deployed fusible links.

Structural Analyses

800, 130

PB88-194345 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Wind Engineering: Recent Investigations and Research Needs.

Final rept.,
E. Simiu. 1987, 11p
Pub. in Proceedings of U.S.-Austria Joint Seminar, Stochastic Structural Mechanics, Boca Raton, FL, May 4-5, 1987, p411-421.

Keywords: Wind velocity, Wind directing, Buildings, Micrometeorology, Offshore structures, Thunderstorms, Tornadoes, *Wind engineering, Wind effects, Wind pressure.

A brief review of recent advances and of outstanding topics in wind engineering is presented. The topics discussed include: the micrometeorological modeling of thunderstorms and tornadoes; the modeling of the

spatial coherence of longitudinal velocity fluctuations; aero/hydroelastic problems in the modeling of compliant offshore platform motions; improved procedures for the probabilistic modeling of extreme wind speeds; the estimation of wind directionality effects; the estimation of conventional 1-minute design loads for cladding glass; the calibration against past practice of the design of structures and parts sensitive to directional effects.

800,131
PB88-217237 PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Literature Review of Post-Installed Anchorage in Concrete,
M. K. Johnson, H. S. Lew, and L. T. Phan. Jun 88, 66p NBSIR-88/3797

Keywords: *Anchors(Fasteners), *Concretes, Loads(Forces), Tension, Shear stresses, Structural members, Strength, Post installed anchors.

The report summarizes current knowledge of post-installed anchor behavior in concrete. Load-displacement behavior and ultimate strength of each type of post-installed anchor are discussed for different loading conditions in both uncracked and cracked concrete. Most knowledge of anchor behavior concerns the response to static tensile loads in uncracked concrete. Many aspects of anchor behavior require further study, especially the behavior of anchors in cracked concrete subjected to combined loadings.

800,132
PB88-218219 PC A07/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Literature Review of Strengthening Methodologies of Existing Structures,
L. T. Phan, H. S. Lew, and M. K. Johnson. Jun 88, 126p NBSIR-88/3796

Keywords: *Structural members, *Reinforced concrete, Strength, Columns(Supports), Beams(Supports), Case studies, Construction joints, Ductility, Buildings, Earthquake engineering.

The report reviews research studies relevant to structural strengthening existing reinforced concrete members and frames. The majority of these studies dealt exclusively with restoring or improving seismic resistance of concrete columns and frames. A number of case histories where various strengthening techniques were applied in practice are reviewed. Most studies identified ultimate failure in the strengthened structures as primarily due to failure of the joining elements. Improved load resistance and ductility in concrete structures have been reported in most of these studies.

800,133
PB89-127278 PC A07/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Structures Div.
Experimental Study of Gusseted Connections for Laterally Braced Steel Buildings,
J. L. Gross, and G. Cheok. Nov 88, 134p NISTIR-88/3849

Keywords: *Gusset plates, *Steel construction, Beams(Supports), Buildings, Structural members, Failure, Buckling, Strains, Loads(Forces), Performance evaluation, Graphs(Charts).

The behavior of three diagonally braced steel subassemblies was studied experimentally. The parameters which were varied included the gusset geometry and column orientation. The specimens were loaded to failure in their plane and load-deformation as well as strain data were recorded. The failure mode for the two strong-axis column connections was gusset buckling. The weak-axis column connection failed by tearing of the gusset plate. The moment introduced by the eccentricity in the bracing was distributed to the beam and column in the strong-axis column connection. This moment was carried almost entirely by the beam in the weak-axis connection due to the flexibility in the web connection. The current method of predicting gusset buckling appears to be very good giving a margin of safety of approximately three. The capacity of the clip angles, in accordance with AISC, was computed to be very low yet no distress in the clip angles was observed. This was because frame action introduced loads in the gusset-to-column bolts which counteracted the load produced by the bracing.

General

800,134
PB88-181193 PC A12/MF A01
Maryland Univ., College Park. Dept. of Mechanical Engineering.
Transient Characteristics of Unconfined Fire Plume-Driven Ceiling Jets.
Final rept.,
V. Motevalli, and C. H. Marks. Feb 88, 255p NBS/GCR-88/540
Grant 70NANBSH0551
See also report dated Apr 87, PB87-201810. Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Ceilings(Architecture), *Fire tests, Flames, Temperature measurement, Velocity measurement, Plumes, Room fires.

Measurements have been made of transient ceiling jet temperature and velocity profiles under an unconfined fiberboard ceiling for fire strength of 0.5 to 2.0 KW and for floor to ceiling heights of 0.5 and 1.0 m. The data indicate that the velocity profiles are independent of time. The temperature profiles show an increase of the maximum ceiling jet temperatures and a decrease of the distance of the maximum temperature from the ceiling with increasing time. The location of the point of maximum velocity and the point of maximum temperature become independent of the ratio of the radial position to ceiling height (r/H) at large values of r/H . The maximum velocities are less than those expected from isothermal wall jet theory.

800,135
PB88-183983 PC A19/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Wind and Seismic Effects. Proceedings of the Joint Panel Meeting of the U.S.-Japan Cooperative Program in Natural Resources (19th) Held at Tsukuba, Japan on May 12-15, 1987.
Final rept.,
N. J. Raufaste. Jan 88, 433p NBSIR-88/3703
See also PB84-167758.

Keywords: *Bridges(Structures), *Building, *Earthquakes, *Wind pressure, *Meetings, Seismic waves, Gust loads, Earth movements, Dynamic structural analysis, Dynamic loads, Dynamic response, Soil mechanics, *Seismic design, *Ground motion, Earthquake engineering.

The Nineteenth Joint Meeting of the U.S.-Japan Panel on Wind and Seismic Effects was held at the Public Works Research Institute, Tsukuba, Japan, from May 12-15, 1987. The publication, the proceedings of the Joint Meeting, includes the program, list of members, panel resolutions, Panel charter, task committee reports, and technical papers. Subjects covered in the papers presented to the panel include: (1) wind engineering; (2) earthquake engineering; (3) storm surge and tsunami; (4) U.S.-Japan Cooperative Research Program; and, (5) results of recent task committee workshops.

800,136
PB88-215512 PC A05/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Building Technology Project Summaries 1988,
N. J. Raufaste. Apr 88, 78p NBSIR-88/3760
See also report for 1987, PB88-109863.

Keywords: Concretes, Construction materials, Technology, Projects, Buildings, *Building technology.

The Center for Building Technology (CBT) of the National Bureau of Standards (NBS) is the national building research laboratory. It works cooperatively with other organizations, private and public, to improve building practices. It conducts laboratory, field, and analytical research. It develops technologies to predict, measure, and test the performance of building materials, components, systems, and practices. This knowledge is required for responsible and cost-effective decisions in the building process and cannot be obtained through proprietary research and development. CBT provides technologies needed by the building community to achieve the benefits of advanced computation and automation. CBT does not promulgate building standards or regulations, but its technologies are widely used in the building industry and adopted by governmental and private organizations that have

standards and codes responsibilities. The report summarizes the projects underway in the Center during 1988.

800,137
PB88-232871 PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Water Spray Suppression of Fully-Developed Wood Crib Fires in a Compartment,
J. Milke, D. Evans, and W. Hayes. Jun 88, 67p NBSIR-88/3745
Sponsored by Federal Emergency Management Agency, Washington, DC.

Keywords: *Fire extinguishing agents, Water, Sprayers, Nozzle flows, Fire fighting, Fire tests, Experimentation, Compartment fires, Wood cribs.

A series of five experiments examining the effects of a simulated fire fighting water spray introduced into a fully-developed compartment fire were conducted for the Federal Emergency Management Agency by the Center for Fire Research at the National Bureau of Standards per Interagency Agreement (EMW-E-1239) Task Order 4A. Data from these tests were intended to be used as a check of predicted results from the Mission Research Corporation Fire Demand Model. The results illustrate the dynamics of compartment fire suppression using water sprays.

800,138
PB88-233846 PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Project Plan for Full Scale Smoke Movement and Smoke Control Tests,
J. H. Klotz. Jun 88, 53p NBSIR-88/3800
Sponsored by American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA., Bell Atlantic Telephone Co., Arlington, VA., Fire Administration, Emmitsburg, MD., and Veterans Administration, Washington, DC.

Keywords: *Safety engineering, *Buildings, Air flow, Pressurizing, Fire tests, Standards, *Smoke control system, Stairwells.

The report presents a project plan to test combinations of zoned smoke control and stairwell pressurization systems under real fire conditions to evaluate the appropriateness of current design methods of analysis for these systems. The report describes the test building, smoke control systems, calibration of building leakage areas, test instrumentation, and test series. As the project progresses much will be learned from the initial stages of work, and the need for some adjustments in the test series or other parts of the project plan may become apparent.

800,139
PB88-238712 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Model of Three-Dimensional Buoyant Convection Induced by a Room Fire.
Final rept.,
R. G. Rehm, H. R. Baum, D. W. Lozier, and D. M. Corley. 1988, 8p
Pub. in Proceedings of National Fluid Dynamics Congress (1st), Cincinnati, OH., July 24-28, 1988, p.1-8.

Keywords: *Convection, Mathematical models, Finite difference theory, Buoyancy, Buildings, Heat transmission, *Building fires, Three-dimensional calculations, Computational fluid dynamics.

A computational model of three-dimensional buoyant convection in an enclosure induced by a weak volumetric source of heat and mass is presented. The hydrodynamics is directly based on the time-dependent inviscid Euler equations; the model is valid in the Boussinesq approximation and also in the more general thermally expandable approximation in which density variations are not necessarily small. No turbulence model or other empirical parameters are introduced. A second-order dissipation-free finite-difference scheme is used to integrate the evolution equations, and an elliptic solver is used to solve the pressure equation. The algorithms have been verified by comparisons with exact solutions to the equations in simple, special cases, and predictions of the overall model have been compared with experimental results. The use of Lagrangian particle tracking allows one to visualize the three-dimensional flow patterns. Computational re-

General

sults are presented in the way for three different enclosures; a cube, a square shaft and a corridor. The phenomena observed is discussed.

BUSINESS & ECONOMICS

Consumer Affairs

800,140

PC A05/MF A01

Improving the Fire Safety of Cigarettes: An Economic Impact Analysis.
Technical note (Final).
R. T. Ruegg, S. F. Weber, B. C. Lippiatt, and S. K. Fuller. Jan 88, 95p NBS/TN-1242

Also available from Supt. of Docs. as SN003-003-02840-1. Sponsored by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Cigarettes, *Economic analysis, Economic impact, Fire safety, Economic models, Impact analysis.

The Cigarette Safety Act of 1984 (Public Law 98-567) created the Technical Study Group (TSG) on Cigarette and Little Cigar Fire Safety to investigate the technical and commercial feasibility, economic impact and other consequences of developing cigarettes and little cigars with 'minimum propensity' to ignite upholstered furniture and mattresses. The report supports the TSG by identifying potential economic impacts from reducing the ignition propensity of cigarettes, documenting a model for assessing economic impacts, and presenting the results of the economic impact analyses for five selected cigarette modifications. The modifications studied address a broad range of cigarette design characteristics: tobacco content, circumference, paper weight, paper porosity, and chemical additives. The impact categories covered by the model include fire losses (deaths, injuries, and property damage), tobacco farming, cigarette manufacturing, Federal excise tax revenue, consumer surplus, health, and employment.

800,141

PC A03/MF A01

Study of the Ignition Inhibiting Properties of Compressed Air Foam.
D. Madrzykowski. Oct 88, 27p NISTIR-88/3880
Sponsored by Fire Administration, Emmitsburg, MD.

Keywords: *Combustion, *Fire resistant materials, *Sprinkler systems, *Foam, *Compressed air, *Surfactants, Fire protection, Fire extinguishing agents, Hydrocarbons, Plywood, Wetting agents, Effectiveness, Ignition, Mass retention.

The report describes an initial step to quantify the effectiveness of water-based compressed air foam (CAF) generated with a synthetic hydrocarbon-based surfactant. Two series of tests were conducted with the synthetic hydrocarbon surfactant based CAF: ignition retardation tests and mass retention tests. The ignition delaying capability of the foam was twice that of water when protecting a T-11 plywood surface irradiated from an external source in the range of 15 kW/sq m to 60 kW/sq m. The mass retention test, conducted on T-11 plywood siding, exhibited an initial retention efficiency for the foam of approximately 20 times the efficiency of water. This type of foam may have potential for improving performance of fixed fire suppression systems, such as residential sprinkler systems. Further study is recommended to generalize the results of these tests and to quantify the extinguishing capabilities of the CAF relative to water.

800,142

PC A13/MF A01

Checking the Net Contents of Packaged Goods.
Final rept.,
C. S. Brickenkamp, S. Hasko, and M. G. Natrella. Sep 88, 287p NBS/HB-133/1989
Supersedes PB85-129153. Also available from Supt. of Docs as SN003-003-02885-1. Library of Congress catalog card no. 88-600574.

Keywords: *Packaging, *Commodities, *Labels, Handbooks, Requirements, Sampling, Tests, Procedures, Net contents, Compliance tests.

The 1989 edition of NBS Handbook 133 amends and updates the second edition as a procedural manual for compliance testing of the net contents statements on packaged goods. It is possible to label goods by weight, volume, length, area, or count. Two categories of sampling plans are provided for packages subject to the average requirement. Other sampling plans are provided for special products. Detailed test procedures for a wide variety of products are also specified. The manual contains information on equipment, test methods, calculations, and test reporting.

Keywords: *Packaging, *Commodities, *Labels, Handbooks, Requirements, Sampling, Tests, Procedures, Net contents, Compliance tests.

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Domestic Commerce, Marketing, & Economics

800,143

PC A03/MF A01

ABC's of Certification Activities in the United States.
Final rept.,
M. A. Breitenberg. Jul 88, 28p NBSIR-88/3821
See also PB87-224309.

Keywords: *Standards, *Standardization, Laboratories, Inspection, Tests, United States, *Certification, Accreditation.

The report, a sequel to NBSIR 87-3576, The ABC's of Standardization Activities in the United States (PB87-224309), provides a further introduction to certification for a reader who is not entirely familiar with this topic. It highlights some of the more important aspects of the field, furnishes the reader with information necessary to make informed purchases, and serves as background for using available documents and services.

International Commerce, Marketing, & Economics

800,144

PC A04/MF A01

Review of U.S. Participation in International Standards Activities.
P. W. Cooke. Jan 88, 71p NBSIR-88/3698

Keywords: *Standardization, *Standards, *International trade, United States, *International standards, ISO, IEC, International Organization for Standardization, International Electrotechnical Commission, USA.

The report describes the role of international standards, their increasingly significant importance in world trade, and the extent of past and current U.S. participation in the two major international standardization bodies; ISO and IEC. The degree of U.S. participation covers the 20 year period 1966 - 1986. A coarse analysis of data indicates some correlation between U.S. participation and recent export performance for several major product categories.

800,145

PC A03/MF A01

GATT Standards Code Activities of the National Bureau of Standards, 1987.
J. R. Overman. Mar 88, 32p NBSIR-88/3747
See also NTN87-0944.

Keywords: *Standards, Notifications, Regulations, Foreign countries, *Gatt standards code, Technical assistance.

The report describes the GATT (General Agreement on Tariff and Trade) Standards Code activities conducted by the Office of Standards Code and Information, National Bureau of Standards (NBS), for calendar year 1987. NBS responsibilities include operating the U.S. GATT inquiry point for information on standards and certification activities; notifying the GATT Secretariat of proposed U.S. Federal government standards-based rules that might significantly affect trade; assisting U.S. industry with standards-related trade problems; and responding to inquiries about proposed foreign and U.S. technical regulations.

800,146

PC A03/MF A01

Summary of the New European Community Approach to Standards Development.
P. W. Cooke. Jun 88, 14p NBSIR-88/3793/1

Keywords: *International trade, *Standardization, International relations, Commerce, Economic analysis, *European economic community, Single European Act of 1986, Imports, Balance of trade, Exports.

The paper summarizes European Community (EC) plans to aggressively pursue its goal of achieving an 'internal market' by 1992 and the standards-related implications of such a program on U.S. exporters. U.S. exporters will be affected by the harmonization of standards, implementation of EC directives, strengthening of European regional standards bodies and other trade policy considerations affecting market access. U.S. Government and EC contacts for obtaining additional information are provided.

CHEMISTRY

Analytical Chemistry

800,147

PC A03/MF A01

Development of NBS (National Bureau of Standards) Thin Glass Films for X-ray Fluorescence Spectrometry.
Final rept.,
P. A. Pella, D. E. Newbury, E. B. Steel, and D. H. Blackburn. 1986, 5p
Pub. in Analytical Chemistry 58, n6 p1133-1137 1986.

Keywords: *Particulates, *Filters, *Spectrometers, *Thin films, *X ray fluorescence, *X ray analysis, *Calibrating, Silica glass, Fabrication, Lead, Zinc, Iron, Aluminum, Silicon, Calcium, Vanadium, Manganese, Cobalt, Copper, Potassium, Titanium, Reprints, *Standard reference materials.

Two thin glass film Standard Reference Materials, SRM 1832 and 1833, have been developed for the calibration of x-ray fluorescence spectrometers especially for the elemental analysis of particulate matter collected on filter media. Each SRM consists of a silica-base film deposited by focused ion-beam coating onto a polycarbonate substrate mounted on an aluminum ring. The glass film (150-180 micrograms/sq. cm.) is an amorphous layer 0.5-0.6 micrometers thick and contains known concentrations of selected elements (as oxides). SRM 1832 is certified for Al, Si, Ca, V, Mn, Co, and Cu, and SRM 1833 for Si, K, Ti, Fe, Zn, and Pb. The fabrication and characterization of these films with respect to elemental homogeneity, composition, and sensitivity to moisture are described.

Keywords: *Particulates, *Filters, *Spectrometers, *Thin films, *X ray fluorescence, *X ray analysis, *Calibrating, Silica glass, Fabrication, Lead, Zinc, Iron, Aluminum, Silicon, Calcium, Vanadium, Manganese, Cobalt, Copper, Potassium, Titanium, Reprints, *Standard reference materials.

800,148

PC A03/MF A01

Compound Identification and Characterization Using Lattice-Formula Matching Techniques.
Final rept.,
A. D. Mighell, and V. L. Himes. 1986, 5p
Pub. in Acta Crystallographica A42, n2 p101-105 1986.

Keywords: *Data bases, Identification, Lattices, Reduction, Reprints, Subcell, Supercell.

The authors have developed a lattice-formula matching technique to be used in conjunction with the NBS Crystal Data file for the identification and characterization of crystalline materials. The technique is reliable, efficient and highly selective. In the first step of the identification/characterization procedure, a unit cell defining the lattice is determined. The cell is then reduced and derivative supercells and subcells are calculated. These cells are then checked against the NBS Crystal Data file in which all lattices have been represented by standard, reduced cells. By routinely calculating derivative supercells and subcells and matching against the file of known compounds, it is possible to find related materials and/or to make an identification in spite of certain types of errors made by the experimentalists (e.g., missing rows of spots on diffraction photographs or the diffractometers, etc.). Finally, the identification obtained by lattice-matching is verified using known chemical data.

800,149

PB88-175195

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Microwave Spectrum and Molecular Conformation of Peroxynitric Acid HOONO₂.

Final rept.,

R. D. Suenram, F. J. Lovas, and H. M. Pickett. 1986,

16p

Pub. in Jnl. of Molecular Spectroscopy 116, n2 p406-421 Apr 86.

Keywords: Reprints, *Peroxynitric acid, *Atmospheric acid, Microwave spectrum, Dipole moment, Molecular conformation, Atmospheric chemistry.

The rotational spectrum of peroxynitric acid has been investigated in the 40-120GHz region. The spectrum of the ground state is complicated by tunneling of the OH group, which causes a doubling of the asymmetric rotor spectrum. The magnitude of the tunneling splitting is such that it causes Coriolis interactions between the energy levels of the two tunneling states which lead to perturbations in the rotational spectrum. A combined analysis of the a- and b-type pure rotational spectrum. A combined analysis of the a- and b-type pure rotational transitions with the c-type tunneling transitions allows a perturbation free determination of the rotational constants for the ground state. A similar analysis of the low lying NO₂ torsional vibration at 145 per (6) cm has also been carried out. The dipole moments for each state have been determined by analysis of the second order Stark effect. The molecular structure analysis indicates that all the heavy atoms are planar and only the hydrogen atom is out of the heavy atom plane. The preferred orientation of the hydrogen atom with respect to the plane of the heavy atoms is at an angle of 106 with respect to the cis conformation.

800,150

PB88-175401

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Potential Sources of Systematic Errors in Tunable Diode Laser Absorption Measurements.

Final rept.,

R. Sams, and A. Fried. 1986, 6p

Pub. in Applied Spectroscopy 40, n1 p24-29 1986.

Keywords: *Absorption spectra, *Spectrometers, Errors, Measurement, Quantitative analysis, Reprints, *Laser spectroscopy.

There are various potential sources of systematic error in tunable diode laser absorption measurements. In the paper, the authors discuss two such sources that are associated with multimode lasing. The first is associated with spatially different modes in a double beam tunable diode laser absorption spectrometer. In the second source of error, the additional modes are coincident with absorption lines not intentionally being studied. Both types of errors can give rise to rather dramatic systematic errors in wavelength and concentration determinations, both of which the authors discuss in detail.

800,151

PB88-175476

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Liquid Membranes.

Final rept.,

R. D. Noble, J. D. Way, and A. L. Bunge. 1988, 41p
Pub. in Ion Exchange and Solvent Extraction - A Series of Advances 10, p63-103 1988.

Keywords: *Membranes, Mathematical models, Experimentation, Evaluation, Reprints, *Liquid membranes.

A review of the liquid membrane separation field is discussed. Both experimental methods and mathematical models are described in some detail. Applications to various liquid and gas phase separations are noted as well as industrial applications.

800,152

PB88-176433

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Determination of Phosphorus in Copper-Based Alloys Using Ion-Exchange Chromatography and Direct-Current Plasma Emission Spectrometry.

Final rept.,

M. S. Epstein, W. F. Koch, K. S. Epler, and T. C.

O'Haver. 1987, 5p

Pub. in Analytical Chemistry 59, n24 p2872-2876, 15 Dec 87.

Keywords: Reprints, *Copper benchmark, *Direct current plasma, *Emission spectrometry, Ion chromatography, Phosphorus, Spectral interference.

Phosphorus is determined directly in acid digests of copper-based alloys by using direct-current plasma emission spectrometry. The spectral overlap interference of copper and iron emission on the most sensitive phosphorus lines is eliminated by ion-exchange separation carried out in the sample flow stream to the emission spectrometer. The separations involve either a cation exchange to retain the interfering elements on the column or an anion exchange using an activated alumina column to retain and preconcentrate the phosphorus. Phosphorus detection limits obtained by using the latter method are 20 times better than those obtained by using continuous aspiration. A detection limit of 10 ng/mL is observed for a 30-min preconcentration time and 2 mL/min sample flow rate. Phosphorus is determined at the 20 micrograms/g level in SRM 875 (cupro-nickel, an alloy containing approximately 90% copper and 10% nickel) and in phosphorized copper SRMs 1251 and 1252 at concentrations from 80 to 400 micrograms/g.

800,153

PB88-176540

Not available NTIS

National Bureau of Standards (NML), Washington, DC. Molecular Spectroscopy Div.

Far-Infrared Spectrum and Ground State Constants of Methyl Amine.

Final rept.,

N. Ohashi, K. Takagi, J. Hougen, W. B. Olson, and

W. J. Lafferty. 1987, 17p

Pub. in Jnl. of Molecular Spectroscopy 126, p443-459 1987.

Keywords: Reprints, *Far infrared, *Methylamine, *Large amplitude motions, Pure rotational spectra, Spectroscopic constants, Torsional tunneling, Inversion tunneling.

The far-infrared spectrum of methyl amine has been studied in the region 40 to 350 cm⁻¹ by Fourier transform spectroscopy with an apodized resolution of 0.005 cm⁻¹ or better. Both the pure rotational spectrum and the spectrum of the fundamental torsional band have been assigned. The paper reports the ground state constants obtained from a global fitting of a data set including ground state microwave transitions from the literature, as well as far-infrared pure rotational ground state transitions and ground state combination differences from the torsional band obtained in the work. Slightly over 1000 energy differences for the ground state with 0 less than or equal to 19 and K less than or equal to J less than or equal to 30 were fit to 30 molecular parameters from a group theoretical formalism developed earlier, and a standard deviation of plus or minus 0.00063 cm⁻¹ was obtained. An ambiguity (noted earlier in the microwave literature) in the determination of the structural parameter p, which arises when two large amplitude motions are present in the molecule, can be understood and resolved using the present formalism.

800,154

PB88-176557

Not available NTIS

National Bureau of Standards (NML), Washington, DC. Molecular Spectroscopy Div.

FTS-Raman Flame Spectroscopy of High-J Lines in H₂ and D₂.

Final rept.,

D. E. Jennings, A. Weber, and J. W. Brault. 1987,

10p

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in Jnl. of Molecular Spectroscopy 126, p19-28 1987.

Keywords: *Hydrogen, *Deuterium, Gases, Reprints, *Raman spectroscopy, *Fourier transform raman spectroscopy, High temperature raman spectroscopy.

High-J rotational transitions in the ground vibrational state of molecular hydrogen and deuterium have been recorded using the FTS-Raman technique. Transitions above those recorded previously at room temperature were observed in diffusion flames burning H₂ with air, and D₂ with air. For H₂ the v = 0-0 S(6) and S(7) transitions, which had not been observed previously, were recorded in the flame spectra. For D₂ the flame spectra yielded measurements of the S(7) through S(12) lines for the first time. By combining flame and room-temperature Raman and infrared measurements it has been possible to improve H₂ ground state rotation constants to fifth order. For D₂, the combination of flame and room-temperature Raman measurements required an extension to fifth-order constants, as compared with the third-order fit which was adequate for the room-temperature data alone. The improved line positions can be applied to transitions observed in the Orion Molecular Cloud.

800,155

PB88-176607

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.

NBS (National Bureau of Standards) Environmental Standard Reference Materials for Use in Validating Water Analysis.

Final rept.,

R. Alvarez. 1985, 6p

Pub. in Safe Drinking Water, Chapter 13, p177-182 1985.

Keywords: *Analytical chemistry, *Halocarbons, Reprints, *Gas chromatography, Priority pollutants, Standard Reference Materials, Water analysis.

NBS issues Standard Reference Materials (SRM's) for validating water analyses and calibrating instrumentation used in these analyses. These SRM's are certified for important inorganic and organic priority pollutants. For the former, three water SRM's are available--two of these are certified for mercury at the micrograms/mL and ng/mL concentrations, the other, for 17 elements at ng/mL concentrations. Unlike the trace elements in water SRM, an SRM for trace organic pollutants in water has not been developed because long-term stability cannot be assured. Therefore two approaches have been undertaken to assist investigators in determining environmental organic contaminants more reliably. In one approach, a device (SRM 1644) for producing known concentrations of three representative polycyclic aromatic hydrocarbons (PAHs) was developed. In the other approach, solutions containing accurate concentrations of priority pollutants in water-miscible organic solvents have been issued for identifying the compounds, adding accurate amounts to water samples, and determining response factors.

800,156

PB88-177589

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.

Accuracy in Trace Analysis.

Final rept.,

R. A. Velapoldi, and R. A. Durst. 1988, 2p

Pub. in Trends in Analytical Chemistry 7, n2 p49, p73 1988.

Keywords: *Accuracy, Environmental, Reprints, *Analytical chemistry, Automated analyses, Chemometrics, Expert systems.

The report summarizes the Plenary and Parallel scientific sessions for the symposium entitled 'Accuracy in Trace Analysis - Accomplishments, Goals, Challenges' held at NBS, September 28 - October 1, 1987.

800,157

PB88-177597

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Gas Phase Reactions of Hydroxyl Radicals with a Series of Esters Over the Temperature Range 240-440 K.

Final rept.,
T. J. Wallington, P. Dagaut, R. Liu, and M. J. Kurylo.
1988, 10p

Contract NASA-W-15816

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in International Jnl. of Chemical Kinetics 20, p177-186 1988.

Keywords: *Alcohols, Temperatures, Pressures, Reprints, *Flash photolysis resonance fluorescence, *Absolute rate constants.

Absolute rate constants were determined for the gas phase reactions of OH radicals with a series of esters using the flash photolysis resonance fluorescence technique. Experiments were performed over the temperature range 240-440 K at total pressures (using Ar diluent gas) between 25-50 torr. The kinetic data for methyltrifluoroacetate (k1) over the complete temperature range, and for methylacetate (k2), and ethylacetate (k3) over the range 296-440 K were used to derive the Arrhenius expressions. At 296 K, the measured rate constants (in units of 10 to the minus 13th power cu.cm. molecule⁻¹s⁻¹) were: k1 = (0.52 plus or minus 0.08), k2 = (3.41 plus or minus 0.29), and k3 = (15.1 plus or minus 1.4). Room temperature rate constants for the OH reactions with several other aliphatic esters were also measured. These were (in the above units): methylformate, (2.27 plus or minus 0.34); ethylformate, (10.2 plus or minus 1.4); n-propylformate, (23.8 plus or minus 2.7); n-butylformate, (31.2 plus or minus 3.3); n-propylacetate, (34.5 plus or minus 3.4); i-propylacetate, (37.2 plus or minus 2.9); n-butylacetate, (41.5 plus or minus 3.0); s-butylacetate, (56.5 plus or minus 5.9); methylpropionate, (10.3 plus or minus 0.4); ethylpropionate, (21.4 plus or minus 3.0); n-propylpropionate, (40.2 plus or minus 3.2); methylbutyrate, (30.4 plus or minus 3.3); ethylbutyrate, (49.4 plus or minus 3.8); n-propylbutyrate, (74.1 plus or minus 3.2), and n-butylbutyrate, (106 plus or minus 13), error limits represent 2-sigma from linear least-squares analyses. The results are discussed in terms of the reaction mechanisms and are compared to previous literature data.

800, 158

PB88-182159

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Wavelength - Dispersive Techniques for Compositional Mapping in Electron - Probe Microanalysis.

Final rept.,
R. B. Marinenko, R. L. Myklebust, D. S. Bright, and D. E. Newbury. 1985, 4p

Pub. in Microbeam Analysis 20, p159-162 1985.

Keywords: Reprints, *Compositional mapping, Digital x ray mapping, *Electron probe microanalysis, Microanalysis, Quantitative WDS mapping, *Wavelength dispersive analysis.

A procedure using wavelength dispersive spectrometers (WDS) for compositional mapping with the electron microprobe is described. Digital maps as large as 128x128 pixels are taken with an automated electron probe. The counts accumulated on each pixel are stored on floppy disk and transferred to a large computer where quantitative calculations are made and maps can be displayed. Problems encountered at low magnifications (200-800x), such as defocusing effects and specimen blemishes are discussed. To test the procedure, homogeneous NBS SRM 481 silver-gold specimens were tested. Maps of the standards are recorded under the same conditions as the maps for the 'unknown' specimens. After dead-time and background corrections are made, a k-ratio is calculated for each pixel point with the respective points on the unknown and standard. A modified version of the NBS data reduction program FRAME is used to calculate the concentration at each point from the k-values. The results are in good agreement with the certified values for these alloys.

800, 159

PB88-187646

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Ion-Chromatographic Determination of Magnesium and Calcium at the Part-Per-Billion Level with Concentrator Columns.

Final rept.,
K. Han, and W. F. Koch. 1987, 4p
Pub. in LC-GC 6, n1 p56, 58-60 1987.

Keywords: *Calcium, Analysis, Eluent, Ion chromatography, Magnesium, Parts per billion, Reprints, *Concentrators, Rainwater.

The determination of magnesium and calcium at the parts-per-billion level has been optimized using ion chromatography aided by a concentrator technique. The factors investigated include composition of the eluents, interference caused by impurities in the delivery liquid and the possible means of eliminating them with a laboratory-packed trap column, and a comparison of suppression efficiencies between two types of suppressors. A reliable, independent method with good accuracy and precision has been developed for water analyses.

800, 160

PB88-187703

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Characterization of Organotin Species Using Microbore and Capillary Liquid Chromatographic Techniques with an Epifluorescence Microscope as a Novel Imaging Detector.

Final rept.,
W. R. Blair, E. J. Parks, G. J. Olson, F. E. Brinckman, M. C. Veleiras-Price, and J. N. Bellama. 1987, 12p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Chromatography 410, p383-394 1987.

Keywords: Reprints, Butyltins, *Capillary liquid chromatography, Epifluorescent microscope, *Imaging detectors, Microbore liquid chromatography, *Organotins.

The novel application of a UV epifluorescence microscope as an imaging detector for microbore and capillary high-performance liquid chromatography (HPLC) is reported. The microscope is focused on an in-line quartz flow cell incorporated down stream of a microbore HPLC column or directly on an optically clear portion of fused-silica capillary columns for analyte detection. The effect of different fluorescent ligand to analyte ratios on detection limits is also reported, as well as the effect of different image volume sizes produced by changes in microscope objective lens magnification power. Determination of relative sensitivities and detection limits for methyl- and butyltin compounds, complexed with fluorescent dyes, reveals that the organotins show decreasing sensitivity as the number of alkyl substituents on the tin atom increases, with minimum detectable amounts of 6-160 pg of analyte-ligand complex.

800, 161

PB88-188461

Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Frequency Measurement of the K=6 Asymmetry Splittings in CH3OH(1).

Final rept.,
L. R. Zink, K. M. Evenson, D. A. Jennings, G. Moruzzi, and M. Inguscio. 1988, 7p
Pub. in Jnl. of Molecular Spectroscopy 127, p44-50 1988.

Keywords: Reprints, *Far infrared, *K splittings, *Methanol.

Tunable far-infrared spectroscopy was applied to the study of small asymmetry doublings in the ground vibrational, ground torsional state of CH3OH. For the first time splittings of K = 6 states were measured. The splitting constant was found to be S(6) = 9(1) times 10 to the minus 19th power MHz, corresponding to a splitting of 360(35)KHz for J=29 and 240(25) KHz for J = 28.

800, 162

PB88-189238

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Critical Assessment of Detection Limits for Ion Chromatography.

Final rept.,
W. F. Koch, and W. Liggett. 1988, 14p
Pub. in Detection in Analytical Chemistry--Importance, Theory, and Practice, ACS (American Chemical Society) Symposium Series 361, Chapter 11, p210-223 1988.

Keywords: Nitrates, Peak detection, Statistics, Reprints, *Chromatograms, *Detection limits, Ion chromatography.

The statistical basis for ion chromatography detection limits is investigated through the analysis of chromatograms by time series methods. Time series methods reveal two important chromatogram noise components, a cyclic variation caused by the pump and some large low-frequency variations with obscure origins. The component due to the pump can be removed from the chromatogram. The causes of the low frequency component should be investigated because these causes may not satisfy the prerequisites of statistical inference. Detection limit assessment depends on the choice of a peak detection algorithm. The algorithm must include a method for separating the low frequency component from the peak of interest and the method for locating the peak in time. Algorithms that search for the peak in time cannot be assessed in the same way as algorithms that involve no search. The difference is discussed.

800, 163

PB88-189758

PC A99/MF E04
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Chemical Engineering.

Handbook of Basic Tables for Chemical Analysis.

Final rept.,
T. J. Bruno, and P. D. N. Svoronos. Apr 88, 932p
NBSIR-88/3085
See also PB86-227113. Prepared in cooperation with City Univ. of New York, and Georgetown Univ., Washington, DC. Dept. of Chemistry.

Keywords: *Chemical analysis, *Chromatography, Tables(Data), Gas chromatography, Infrared spectroscopy, Ultraviolet spectroscopy, Mass spectroscopy, Nuclear magnetic resonance, Qualitative analysis, Quantitative analysis, Liquid column chromatography.

The work began as a slim booklet prepared by one of the authors (TJB) to accompany a course on chemical instrumentation presented at the National Bureau of Standards, Boulder Laboratories. The booklet contained tables on chromatography, spectroscopy, and chemical (wet) methods, and was intended to provide the students with enough basic data to design their own analytical methods and procedures. Shortly thereafter, with the co-authorship of Prof. Paris D. N. Svoronos, it was expanded into a more extensive compilation entitled Basic Tables for Chemical Analysis, published as National Bureau of Standards Technical Note 1096. That work has now been expanded and updated into the present body of tables. Although there have been considerable changes since the first version of these tables, the aim has remained essentially the same. The authors have tried to provide a single source of information for those practicing scientists and research students who must use various aspects of chemical analysis in their work. In this respect, it is geared less toward the researcher in analytical chemistry than to those practitioners in other chemical disciplines who must have routine use of chemical analysis.

800, 164

PB88-189782

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Determination of Added Chromium (III) and Chromium (VI) in Natural Water by Ion-Pairing High-Performance Liquid Chromatography with Detection by Atomic Absorption Spectrometry.

Final rept.,
A. Syty, R. G. Christensen, and T. C. Rains. 1988, 5p
Pub. in Jnl. of Analytical Atomic Spectrometry 3, p193-197 Jan 88.

Keywords: *Chemical analysis, *Chromium, Water analysis, Reprints, Atomic absorption spectrometry, High performance liquid chromatography, Natural water.

A simple, rapid and selective method for the determination of Cr(3+) and Cr(6+) in natural waters by ion-pairing high-performance liquid chromatography (HPLC) with flame atomic absorption spectrometry (FAAS) as the method of detection is described. The samples and standards are acidified with glacial acetic acid to a pH of 3.1-3.2. The eluent consists of dilute tetrabutylammonium phosphate also acidified to a pH of 3.1-3.2. Separation is accomplished on a 4 cm long column packed with polymeric C18 material. The effluent from the column is fed directly into the atomic ab-

sorption spectrometer. Chromium (VI) added to pond water began to decay to Cr(3+) immediately upon addition. The rate of decay depended on the level of suspended organic material in the water. The recovery of the sum of both Cr(3+) and Cr(6+) species in 65 spiked water samples was 100.9% with a standard deviation of 6.2%.

800,165

PB88-189808 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Gas-Liquid Chromatography of Polychlorinated Biphenyl Congeners between a Nematic Liquid Crystal Phase and a Nonpolar Phase.

Final rept.,
W. L. Zielinski, M. M. Miller, G. Ulma, and S. P. Wasik. 1986, 5p
Pub. in Analytical Chemistry 58, n13 p2692-2696 Nov 86.

Keywords: Reprints, *Gas liquid chromatography, *Polychlorinated biphenyls, *Liquid crystals, Retention selectivity crystals, Thermodynamics.

GLC retention data are presented for biphenyl and 54 polychlorinated biphenyls having 1-10 chlorine atoms using a nematic liquid crystal phase in its supercooled state and a classic non-polar stationary phase. The enhanced selectivity of the liquid crystal phase is examined analytically and thermodynamically. The selectivity differences between the two phases allow many of the PCB congeners to be resolved.

800,166

PB88-189998 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Quantitative Compositional Mapping on an Electron Microprobe.

Final rept.,
R. L. Myklebust, R. B. Marinenko, D. E. Newbury, and D. S. Bright. 1986, 4p
Pub. in Electron Microscopy and Analysis 1985, Proceedings of Institute of Physics Electron Microscopy and Analysis Group Conference, Newcastle-upon-Tyne, England, September 2-5, 1985, p219-222 1986.

Keywords: Quantitative analysis, X ray spectrometry, *Compositional mapping, Digital imaging, *Electron microprobe.

Techniques for digitally accumulating x-ray maps with wavelength-dispersive spectrometers on an electron microprobe are discussed. Methods for background correction and spectrometer defocussing are presented as well as methods for obtaining the composition at every picture point on the map. Compositional maps of homogeneous materials are presented to demonstrate the validity of the techniques.

800,167

PB88-190004 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Compositional Mapping of Thick Specimens.

Final rept.,
D. E. Newbury. 1985, 5p
Pub. in Microbeam Analysis 20, p204-208 1985.

Keywords: Reprints, *Compositional mapping, Electron probe microanalysis, Ion microscopy, Microanalysis, Secondary ion mass spectrometry, Surface imaging.

Compositional maps derived by digital signal collection techniques offer distinct advantages over conventional analog collection and presentation methods. Digital maps can be manipulated by imageprocessing techniques to enhance contrast visibility. Full quantitative analysis treatment can be applied to each image point to yield a true compositional map. Compositional maps based upon electron-excited x-rays are being augmented by other mapping techniques, including Auger electrons for surface images and ion microscopy for trace messages.

800,168

PB88-192182 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Ultrasonic Characterization of Residual Stress and Texture in Cast Steel Railroad Wheels.

Final rept.,
A. V. Clark, H. Fukuoka, D. V. Mitrovic, and J. C. Moulder. 1987, 9p
Sponsored by Federal Railroad Administration, Washington, DC.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, Chapter 6B, v2 p1567-1575 1987.

Keywords: Texture, Reprints, *Acoustic birefringence, Acoustoelasticity, *Railroad wheels, Residual stress, *Ultrasonic stress measurement.

An ultrasonic technique has been used to characterize the state of residual stress and texture in the rims of cast steel railroad wheels. Orthogonally polarized shear-horizontal (SH) waves are propagated through the thickness of the rim in pulse-echo mode. The (normalized) difference of arrival times of these waves (acoustic birefringence) depends upon both texture and stress. The birefringence, B, was measured with two transducers: an electromagnetic-acoustic transducer (EMAT) and a piezoelectric transducer made of PZT. Two wheels were tested. The wheel had a sawcut, which locally relieved the residual (hoop) stress. Measurement of the birefringence at the sawcut allowed us to estimate the contribution of texture, which the authors subtracted from values of B at stressed locations. Values of hoop stress obtained with the EMAT and PZT transducer agreed to within 10 MPa, for transducers placed on the center of the back face of the rim.

800,169

PB88-192349 (Order as PB88-192331, PC A06)
Delaware Univ., Newark.

Measurement of the Universal Gas Constant R Using a Spherical Acoustic Resonator,

M. R. Moldover, J. P. M. Trusler, T. J. Edwards, J. B. Mehl, and R. S. Davis. 30 Oct 87, 57p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Pub. in Jnl. of Research of the National Bureau of Standards, v93 n2 p85-144 Mar-Apr 88.

Keywords: *Argon, *Ideal gas law, *Constants, Mercury, Temperature measurement, Uncertainty, Acoustic measurement, *Universal gas standard.

The authors report a new determination of the Universal Gas Constant R: $(8.314\,471 \pm \text{or} - 0.000\,014) \text{ J/K mol}$. The uncertainty in the new value is 1.7 ppm (standard error), a factor of 5 smaller than the uncertainty in the best previous value. The gas constant was determined from measurements of the speed of sound in argon as a function of pressure at the temperature of the triple point of water. The speed of sound was measured with a spherical resonator whose volume was determined by weighing the mercury required to fill it at the temperature of the triple point. The molar mass of the argon was determined by comparing the speed of sound in it to the speed of sound in a standard sample of argon of accurately known chemical and isotopic composition.

800,170

PB88-193818 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Development of an Automated Digital Image Acquisition System for AEM (Analytical Electron Microscope).

Final rept.,
E. B. Steel, R. L. Myklebust, and A. A. Bell. 1985, 2p
Pub. in Microbeam Analysis, p151-152 1985.

Keywords: *Chemical analysis, Data acquisition, Automation, Reprints, *Electron microscope, *Image processing, VAX-11/730 computers, Microbeams, Computer applications, Real time.

A VAX 11/730 computer was interfaced to a JEOL 200 CX analytical electron microscope for the purpose of producing and manipulating digital images from the microscope, and communicating in real time with a VAX 11/780. This combination of computers allows fast acquisition and sophisticated manipulation of large image arrays. Other systems dependent on microcomputers, are often memory making sophisticated real time image analysis difficult or impossible.

800,171

PB88-193834 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Quantitative Calculations for Compositional Mapping Techniques in Electron Probe Microanalysis.

Final rept.,
R. Myklebust, R. Marinenko, D. Newbury, and D. Bright. 1985, 3p
Pub. in Microbeam Analysis, p101-103 1985.

Keywords: *X ray analysis, *Microanalysis, *Quantitative analysis, *Electron probes, Computations, Mapping, Correction, Reprints, Microbeams, Computer applications.

Computational procedures for correcting x-ray intensity data obtained with wavelength dispersive spectrometers on electron microprobes are discussed. The special problems encountered in the corrections for compositional maps are examined, such as spectrometer defocussing when the electron beam is moved off of the focussed position. One computer program makes all of these corrections in addition to performing all of the matrix corrections at each data point in the map.

800,172

PB88-194295 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Synchrotron Radiation: Applications to Chemistry.

Final rept.,
A. C. Parr. 1985, 38p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in New Directions in Chemical Analysis, p161-198 1985.

Keywords: *Synchrotron radiation, Spectroscopy, Photoionization, Uses.

The nature and history of synchrotron radiation is briefly covered, with an emphasis on results and observations rather than a mathematical development. Several examples of the applications of synchrotron radiation as a tool to solve chemical and physical problems is developed, with sample results given. Areas of substantial research interests are indicated, along with projections on future developments.

800,173

PB88-200332 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Calibration of Infrared Absorption Measurements of Interstitial Oxygen Concentration in Silicon.

Final rept.,
W. M. Bullis, M. Watanabe, A. Baghdadi, Y. Z. Li, R. I. Scace, B. W. Serise, and P. Stollhofer. 1986, 13p
Pub. in Proceedings of Electrochemical Society Silicon Symposium, Boston, MA., May 4-9, 1986, 13p.

Keywords: *Silicon, *Oxygen, *Interstitials, Infrared analysis, Trace elements, Semiconductors, Calibration.

Many calibration factors for infrared absorption measurements of oxygen in silicon have been reported in the literature and adopted as standard during the past three decades. Reasons for this variability are examined, and a new international experiment to establish a universally acceptable value and the reliability to which it can be found are described.

800,174

PB88-201348 PC A04/MF A01
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Certification of SRM 1879 Respirable Cristobalite as a Quantitative X-ray Diffraction SRM,
M. A. Kuchinski, C. R. Hubbard, and C. Robbins. Apr 88, 65p NBSIR-88/3742

Keywords: *Cristobalite, Chemical analysis, Silicon organic compounds, X ray diffraction, *Standard reference materials.

Well characterized, highly crystalline standard materials are essential for accurate quantitative x-ray powder diffraction work. Synthetic cristobalite powder was certified as a Standard Reference Material for quantitative x-ray diffraction analysis of cristobalite content. Elemental analysis revealed only trace impurities; the largest being Al at 1000 ppm. Quantitative determination of the crystallinity of the material was performed. The certified crystalline purity of the cristobalite SRM 1879 was 98.0 weight percent crystalline cristobalite. The estimated standard deviation was 1.0 weight percent arising from a standard deviation of 0.5 weight percent due to random and inhomogeneity errors plus

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an estimated likely systematic error of 0.5 weight percent.

800,175

PB88-203716

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Effect of Bremsstrahlung-Produced Fluorescence on X-ray Microanalysis in the Analytical Transmission Electron Microscope.

Final rept.,

M. E. Twigg. 1987, 2p

Pub. in Proceedings of Anal. Electron Microsc. Workshop, p325-326 1984.

Keywords: *X ray analysis, *X ray fluorescence, Microanalysis, Bremsstrahlung, Fluorescence, Electron microscopy.

It has been found that the contribution of continuum fluorescence to characteristic x-ray intensities in electron-irradiated thin foils can be significant. This effect must then be considering in the microelemental analysis of thin foil specimens in the analytical transmission electron microscope.

800,176

PB88-211818

PC A04/MF A01

National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

NBS (National Bureau of Standards) Measurement Services: Neutron Source Strength Calibrations,

Special pub. (Final),

E. D. McGarry, and E. W. Boswell. Mar 88, 62p

NBS/SP-250/18

Also available from Supt. of Docs. See also PB87-174041. Library of Congress catalog card no. 88-600510.

Keywords: *Calibrating, *Neutron sources, Manganese inorganic compounds, *Manganese sulfate.

The manganese sulfate (MnSO₄) bath method of neutron source strength calibration at NBS is described and compared briefly with other MnSO₄ bath techniques used internationally. The accuracy of source intercomparisons and practical limitations of the NBS system. In particular, there is discussion of uncertainties associated with system limitations and with corrections necessary for neutron capture in the source, capture of fast and thermal neutrons by competing reactions in the MnSO₄, capture of neutrons in the source container, and the correction for leakage of neutrons from the bath, which is 1.27 meters in diameter.

800,177

PB88-211826

PC A07/MF A01

National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

NBS (National Bureau of Standards) Measurement Services: Calibration of X-ray and Gamma-ray Measuring Instruments.

Special pub. (Final),

P. J. Lampert, T. P. Loftus, and R. Loevinger. Mar 88, 140p NBS/SP-250/16

Also available from Supt. of Docs. See also PB87-174041. Library of Congress catalog card no. 88-600515.

Keywords: *Calibrating, *Measurement, Standards, Gamma irradiation, X ray irradiation, Quality assurance, Laboratory equipment.

The calibration and irradiation of x-ray and gamma-ray instruments are performed in terms of the physical quantity exposure. The calibrations are listed in NBS Special Publication 250 as calibrations 46010C through 46050S (formerly 8.3A through 8.3M). A calibration or correction factor is provided for radiation detectors, charge sensitivity of a high-gain electrometer is tested, and passive dosimeters are given known exposures. Calibration is performed by comparing the instrument against an NBS primary standard of exposure, which is a free-air chamber for x-rays and a cavity ionization chamber for cesium-137 and cobalt-60 gamma rays. A variety of quality assurance checks are performed to assure the constancy of the standards and the accuracy of the calibrations and irradiations. The overall uncertainty is given as 0.7% for exposure rate in the NBS beams, 1% for calibration of a cable-connected chamber and irradiation of passive dosimeters, and 1.5% for calibration of a condenser chamber.

800,178

PB88-217427

PC A04/MF A01

National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.

Standard Reference Materials: Standardization of pH Measurements (1988 Edition).

Special pub. (Final),

Y. C. Wu, W. F. Koch, and R. A. Durst. Feb 88, 60p

NBS/SP-260/53

Also available from Supt. of Docs. Supersedes PB-248127. Library of Congress catalog card no. 75-619344.

Keywords: *Standardization, *pH meters, Standards, Chemical analysis, pH, Measurement, Solutions, Buffers (Chemistry), Calibrating, *Standard reference materials, Glass electrodes.

One of the most widely performed analytical measurements in chemical laboratories is that of pH using the glass electrode. In order to ensure the consistency of these measurements, the National Bureau of Standards has recommended an operational scale of pH, maintained in terms of the pH(S) of a series of standard solutions. Certified samples of buffer materials, from which the standard reference solutions of reproducible pH can be prepared, as well as solutions in the case of rainwater, are issued by the National Bureau of Standards as Standard Reference Materials. The report is concerned primarily with a discussion of the method used at NBS for the assignment of pH(S) values to these standard solutions, a description of the NBS measurement facilities for pH, and a summary of the characteristics of the buffer materials. A brief discussion of the types of electrodes used and the calibration of pH instrumentation is also presented.

800,179

PB88-217849

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Determination of Polycyclic Aromatic Hydrocarbons in a Coal Tar Standard Reference Material.

Final rept.,

S. A. Wise, B. A. Benner, G. D. Byrd, S. N. Chesler,

R. E. Rebert, and M. M. Schantz. 1988, 8p

Pub. in Analytical Chemistry 60, n9 p887-894, 1 May 88.

Keywords: *Aromatic polycyclic hydrocarbons, *Chromatographic analysis, *Coal tar, Chemical analysis, Gas chromatography, Standards, Reprints, *Standard reference material, Liquid chromatography.

A new Standard Reference Material (SRM) has been certified for use in the determination of polycyclic aromatic hydrocarbons (PAH). SRM 1597 is a natural, complex, combustion-related mixture of PAH isolated from coal tar. Certified concentrations, based on the agreement of results from both gas chromatography (GC) and liquid chromatography (LC), are reported for 12 PAH. Approximately 65 compounds were identified in SRM 1597 based on molecular weight and/or GC retention information. The SRM is intended for use in the evaluation and validation of analytical methods for the determination of PAH in complex mixtures and in the evaluation of efficiency and selectivity of chromatographic systems.

800,180

PB88-217872

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Separation and Identification of Polycyclic Aromatic Hydrocarbon Isomers of Molecular Weight 302 in Complex Mixtures.

Final rept.,

S. A. Wise, B. A. Benner, H. Liu, G. D. Byrd, and A.

Colmsjo. 1988, 8p

Pub. in Analytical Chemistry 60, n7 p630-637, 1 Apr 88.

Keywords: *Aromatic polycyclic hydrocarbons, *Chromatographic analysis, *Coal tar, Chemical analysis, Gas chromatography, Chemical composition, Mass spectroscopy, Reprints, *Particulate matter, Liquid chromatography, Dibenzopyrenes, Dibenzofluoranthenes.

The determination of dibenzopyrenes and dibenzofluoranthenes (isomers of molecular weight 302) in complex mixtures has received relatively little attention for several reasons including low concentrations in environmental samples, the number of possible isomers, and the lack of reference compounds for comparison. The paper describes the separation and identification of isomers of molecular weight 302 in a coal tar extract. The compounds were isolated from the extract by normal-phase liquid chromatography (LC). Thirteen

isomers were identified by using a combination of reversed-phase LC, gas chromatography, gas chromatography/mass spectrometry, and low-temperature (Shpol'skii) fluorescence spectroscopy.

800,181

PB88-230388

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Low-Blank Chemical Separation of Rhenium and Osmium from Gram Quantities of Silicate Rock for Measurement by Resonance Ionization Mass Spectrometry.

Final rept.,

R. J. Walker. 1988, 4p

Pub. in Analytical Chemistry 60, n11 p1231-1234, 1 Jun 88.

Keywords: *Silicate minerals, *Osmium, *Rhenium, Distillation, Compositions, Solvent extraction, Reprints, *Separation processes, Resonance ionization mass spectrometry.

Procedures have been developed so that nanogram quantities of Re and Os can be cleanly and efficiently separated from gram quantities of silicate rock. Concentrations of these elements can subsequently be determined by isotope dilution and the isotopic composition of Os obtained by using resonance ionization mass spectrometry. Typically, 1-10 g of rock powder is spiked with (185)Re and (190)Os and then dissolved in sealed digestion vessels made of Teflon fluorocarbon resin by using a combination of HF, HCl and ethanol. Once the rock is in solution and equilibrated with the spike, the solution is evaporated to dryness and the residue redissolved in H₂SO₄. Ceric sulfate is added to the solution and Os is distilled from the rock matrix as OSO₄ by using a reflux condenser-distillation apparatus. The OSO₄ is trapped and reduced in a 3:1 mixture of HCl and ethanol. Re is extracted from the H₂SO₄/rock solution into a solution of tribenzylamine in chloroform. Re is subsequently back-extracted into concentrated ammonium hydroxide. Chemical blanks are <20 pg for Re and <5 pg for Os. Separation efficiencies are >70 percent for both elements at the nanogram level. Replicate analyses generally give results within 5 percent of the average.

800,182

PB88-230420

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Inductively Coupled Plasma Mass Spectrometric Analysis of Ultrapure Acids.

Final rept.,

P. J. Paulsen, E. S. Beary, D. S. Bushee, and J. R.

Moody. 1988, 5p

Pub. in Analytical Chemistry 60, n10 p971-975, 15 May 88.

Keywords: *Acids, Trace elements, Concentration (Composition), Isotopes, Reprints, *Trace analysis.

The inductively coupled plasma mass spectrometer (ICP-MS) and chemical procedures have been developed which enable the analysis of ultrapure acids and similar materials for trace elements at concentrations of a few picograms per gram (10 to the minus 12th power g/g) and less. Compared to previously reported methods for multielement analysis, the sensitivity has been improved for all elements, some by an order of magnitude and more. Sample throughput has been dramatically improved compared to the spark source mass spectrometer and methods have been developed to quantify simultaneously elements by either isotope dilution analysis or external standard calibration techniques.

800,183

PB88-237270

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Shape Selectivity in Liquid and Gas Chromatography: Polymeric Octadecylsilane (C18) and Liquid Crystalline Stationary Phases.

Final rept.,

S. A. Wise, L. C. Sander, H. C. K. Chang, K. E.

Markides, and M. L. Lee. 1988, 7p

Pub. in Chromatographia 25, n6 p473-479 Jun 88.

Keywords: *Aromatic polycyclic hydrocarbons, Separation, Selectivity, Liquid crystals, Gas chromatography, Preparation, Retarding, Reprints,

*Isomers(Molecular), *Octadecylsilane, Liquid chromatography, Stationary phases.

Octadecylsilane (C18) stationary phases for liquid chromatography (LC), which are prepared by polymeric rather than monomeric phase synthesis, exhibit shape selectivity for isomeric polycyclic aromatic hydrocarbons (PAH) that is similar to the shape selectivity observed for liquid crystalline phases in gas chromatography (GC). Relative retention measurements for several sets of isomeric PAH on a polymeric C18 stationary phase (reversed-phase LC) and liquid-crystalline polysiloxane stationary phase (capillary GC) were compared and correlated with the simple length-to-breadth shape descriptor of the solute. Similar retention behavior was observed for both chromatographic systems. In fact, anomalies in elution order relative to length-to-breadth ratios were generally found to be consistent in both chromatographic systems and could often be ascribed to secondary shape factors (i.e., planarity of the molecule).

800,184
PB88-244553 PC A16
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 93, Number 3, May-June 1988, 357p
Also available from Supt. of Docs. as SN703-027-00022-9. See also Volume 93, Number 2, PB88-192331. Library of Congress catalog card no. 63-37059.

Keywords: *Chemical analysis, *Microanalysis, *Quantitative analysis, *Meetings, Analyzing, Quality assurance, Chemical composition, Laboratory equipment, Robots, Standards, Ion beams, Chromatographic analysis, Mass spectroscopy, Spectroscopy, Trace elements, Radioactivation analysis, Spectrochemical analysis, Error analysis, Nuclear radiation spectroscopy, Trace amounts, Environmental research, Clinical laboratories.

A special issue presents the proceedings of a 1987 conference that focused on an assessment of the current state of knowledge and practice in trace chemical analysis. Following eight expert overview papers covering the past and current status of trace analysis and areas of current growth, the remainder of the text presents numerous technical papers grouped among three principal themes: (1) considerations of the measurement process (including quality assurance, reference materials, industrial trace analysis, chemometrics, and sample preparation and processing); (2) quantitation in material, environmental, clinical, and nutrient analysis; and (3) advances in analytical techniques (covering chromatography, mass spectrometry, molecular spectroscopy, atomic spectroscopy, nuclear methods, electrochemistry, bioanalytical/biosensors, and microprobe techniques). Graphic and tabular data are presented throughout the text.

800,185
PB89-101463 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Digital X-ray Compositional Mapping with 'Standard Map' Corrections for Wavelength Dispersive Spectrometer Defocusing.
Final rept.,
R. B. Marinenko, R. L. Myklebust, D. S. Bright, and D. E. Newbury. 1987, 17p
Pub. in Jnl. of Microscopy 145, pt2 p207-223 Feb 87.

Keywords: *Chemical analysis, *Mapping, Concentration(Composition), Image processing, X ray spectroscopy, Correction, Reprints, *Electron microprobe analysis, Defocusing, Binary alloys.

Digital compositional mapping with the electron microprobe is rapidly replacing conventional X-ray area scan techniques which rely upon photographic records. Digital X-ray data stored on a disk can be displayed and modified by image processing algorithms. Furthermore, the raw data can be manipulated to provide quantitative information about the area of the specimen studied. Quantitative compositional mapping by wavelength dispersive X-ray spectrometry requires special corrections for the defocusing effect of the crystal spectrometers at lower magnifications when the mapped area exceeds 50 micrometers on a side. In the work, one of several possible procedures to correct the defocusing effect was developed. The 'standard map' correction procedure uses a map of a standard to calculate a k-ratio for each pixel point in a map of an unknown. Then a concentration can be calculated

at each point from each k-ratio. The effectiveness of the procedure is demonstrated on homogeneous, binary alloys. Several examples are given of applications to mapping low-concentration components along grain boundaries.

800,186
PB89-101471 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
NBS (National Bureau of Standards) Standards for Microanalysis: Certification and Applications.
Final rept.,
R. B. Marinenko, and E. B. Steel. 1986, 17p
Pub. in J. Trace and Microprobe Techniques 4, n3 p129-145 1986.

Keywords: *Chemical analysis, *Microanalysis, Standards, Trace elements, Research projects, Thin films, Electron probes, Glass, Reprints, *Standard reference materials, Transmission electron microscopy.

Accurate quantitative analysis with microanalytical techniques requires well-characterized standards that are homogeneous on the micrometer scale. Standards that contain two, three or more well-characterized elements in a single material are often more useful than pure elements, but microhomogeneity is sometimes difficult to achieve for complex materials. They will describe the process of certifying materials at the National Bureau of Standards (NBS) for use as standards in microanalytical techniques and how they can be used in the analytical community.

800,187
PB89-101703 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Isotope Dilution Spark-Source Mass Spectrometric Determination of Total Mercury in Botanical and Biological Samples.
Final rept.,
J. R. Moody, and P. J. Paulsen. 1988, 5p
Pub. in Analyst 113, p923-927 Jun 88.

Keywords: *Mercury(Metal), *Trace elements, Chemical analysis, Mass spectroscopy, Isotopic labeling, Chemical composition, Reprints, *Trace amounts, Ecological concentration.

A combustion technique for the isolation of mercury from organic matrices is described which minimizes the chemical blank. The operating parameters for isotope dilution spark source mass spectrometry have been optimized for these samples. Concentrations of ca.0.1 ppm in solid samples, such as tuna, leaves and urine, have been determined with a precision of about 4 percent.

800,188
PB89-118988 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Primary Standards In Activation Analysis.
Final rept.,
D. A. Becker. 1987, 14p
Pub. in Jnl. of Radioanalytical and Nuclear Chemistry 113, n1 p5-18 1987.

Keywords: *Radioactivation analysis, *Trace elements, *Neutron activation analysis, Calibrating, Comparison, Standards, Laboratory equipment, Samples, Reprints, *Reference materials.

The availability of natural matrix reference materials evaluated for trace element content has resulted in their widespread use as standards (i.e., calibration materials; comparators) for instrumental neutron activation analysis (INAA). Due to the uncertainties associated with their certified values, the limited number available, and the relative matrix independence of INAA, these reference materials are more properly utilized as quality assessment materials, after calibration of the INAA analytical system with true primary standards. Terminology is defined, the use of matrix reference materials to evaluate the analytical system is discussed, techniques for trace element analyses are reviewed, and necessary precautions in the accurate comparison of samples to standards are presented.

800,189
PB89-118996 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Speciation of Mercury Using Liquid Chromatography with Detection by Inductively Coupled Plasma Mass Spectrometry.

Final rept.,
D. S. Bushee. 1988, 4p
Pub. in Analyst 113, p1167-1170 Aug 88.

Keywords: *Chemical analysis, Mass spectroscopy, Performance evaluation, Reprints, *Inductively coupled plasma mass spectroscopy, *Mercury compounds, Mercury/methyl.

An inductively coupled plasma mass spectrometer was used as a liquid chromatographic detector for the determination of mercury compounds. The detection limits were in the low microg/ml range and were improved further by post-column cold-vapor generation. The results obtained were linear over three to four orders of magnitude. Blind, spiked water samples were used to validate the method. The method was applied to the determination of methylmercury in an NBS RM-50 Albacore tuna sample (873 + or - 60 microg/ml) and to the determination of thimerosal in contact lens solutions. Good agreement was observed between the literature and/or expected values and the values determined experimentally.

800,190
PB89-119002 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Advances in Microradiocarbon Dating and the Direct Tracing of Environmental Carbon.
Final rept.,
G. A. Klouda, L. A. Currie, R. M. Verkouteren, W. Einfield, and B. D. Zak. 1988, 7p
Pub. in Jnl. of Radioanalytical and Nuclear Chemistry 123, n1 p191-197 1988.

Keywords: *Archaeology, *Geophysical surveys, *Radiocarbon dating, Chemical analysis, Mass spectroscopy, Performance evaluation, Reprints, *Air pollution detection, *Trace studies, *Accelerator mass spectroscopy.

The advent of Accelerator Mass Spectrometry (AMS) has brought about a major change in the practice of (sup 14) C measurement, having far reaching implications for archaeological, environmental and geophysical applications. 'Micro-' measurements are beginning to be realized in the context of sample sizes, and the promise exists also in the context of isotope ratios, or ages. These new capabilities are the result of direct ((sup 14) C) 'atom counting', which is at least one thousand times more efficient than beta particle 'decay counting'. The contrast between these two approaches may be seen from the facts that (a) the former yields sufficient counts for 'quantitative dating' (1% Poisson error) from only 35 micrograms of modern carbon, and (b) its characteristic counting. For environmental studies, where source apportionment precision requirements are relaxed to ca. 10% RSD, the characteristic limiting sample size is reduced to less than 1 microgram.

800,191
PB89-119150 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Determination of Fat Soluble Vitamins in Oil Matrices by Multidimensional High-Performance Liquid Chromatography.
Final rept.,
J. M. Brown-Thomas, A. A. Moustafa, S. A. Wise, and W. E. May. 1988, 5p
Pub. in Analytical Chemistry 60, n18 p1929-1933, 15 Sep 88.

Keywords: *Vitamins, *Plant oils, *Chemical analysis, *Cod liver oil, Ergocalciferol, High pressure liquid chromatography, Vitamin E, Vitamin A, Standards, Reprints.

Multidimensional high-performance liquid chromatographic procedures for the determination of selected fat-soluble vitamins in foodlike oil matrices are presented. An on-line liquid chromatographic procedure, which was developed for the certification of selected fat-soluble vitamins in Standard Reference Material (SRM) 1563, Cholesterol and Fat-Soluble Vitamins in Coconut Oil, utilizes gel permeation chromatography (GPC) and normal-phase high-performance liquid chromatography (HPLC) to quantify retinyl acetate and ergocalciferol. The on-line GPC/normal-phase HPLC procedure was followed by a reversed-phase HPLC

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step to quantify di- α -tocopheryl acetate in the fortified coconut oil. A modified procedure has also been used for the determination of α -tocopherol in SRM 1588, Organics in Cod Liver Oil.

800,192

PB89-123996

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Improved Method for the High-Precision Isotopic Measurement of Boron by Thermal Ionization Mass Spectrometry.

Final rept.,

Y. Xiao, E. S. Beary, and J. D. Fassett. 1988, 11p
Pub. in International Jnl. of Mass Spectrometry and Ion Processes 85, p203-213 1988.

Keywords: *Boron, *Isotope separation, Performance evaluation, Reprints, *Thermal ionization mass spectrometry.

An improved procedure for the determination of boron isotopic ratios, which is based on the measurement of the ion $\text{Cs}_2\text{BO}_2^+(\text{sup} + 1)$ has been investigated. Improved signal intensity and reproducibility is achieved by coating the filament substrate with graphite. Measurement of the $(\text{sup} 11)\text{B}/(\text{sup} 10)\text{B}$ ratio with a relative standard deviation of 0.006% has been demonstrated. The effect of various experimental factors on precision, including sample size, $\text{Cs}:\text{B}$ ratio, and sample purity, have been evaluated. The boron isotopic compositions of samples of borax from the United States and Turkey are compared.

800,193

PB89-124069

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Analysis of Ultratrace Lithium and Boron by Neutron Activation and Mass Spectrometric Measurement of $(3)\text{He}$ and $(4)\text{He}$.

1987,

W. B. Clarke, M. Koekebakker, R. D. Barr, R. G. Downing, and R. F. Fleming. 1987, 9p
Sponsored by McMaster Univ., Hamilton (Ontario).
Pub. in Applied Radiation and Isotopes 38, n9 p735-743 1987.

Keywords: *Lithium, *Boron, *Chemical analysis, *Neutron activation analysis, *Mass spectrometry, Helium isotopes, Blood, Thermal neutrons, Reprints.

A new technique for analysis of lithium and boron at ultratrace levels is described. The method consists of mass spectrometric assay of 3He from decay of tritium produced by thermal neutron reaction on 6Li , and 4He produced by thermal neutron reaction on 10B . Two neutron irradiation facilities were used: The McMaster reactor and a graphite moderated thermal column attached to the NBS reactor. In the McMaster irradiations, fast neutrons (0.2 MeV) induce the threshold reactions $14\text{N}(n,3\text{H})^{12}\text{C}$, $12\text{C}(n,9\text{Be})^{16}\text{O}(n)^{13}\text{C}$, and $14\text{N}(n)^{11}\text{B}$. These reactions become serious sources of error in samples such as human blood which have very low concentrations of lithium and boron, and high concentrations of nitrogen, carbon and oxygen. In the NBS thermal column, fast neutron reactions are virtually absent, and only corrections for thermal neutron capture by deuterium, and thermal neutron reactions on oxygen, sulfur, chlorine, potassium, and calcium need to be taken into account.

800,194

PB89-127104

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Determination of Nitrogen Dioxide in Air Compressed Gas Mixtures by Quantitative Tunable Diode Laser Absorption Spectrometry and Chemiluminescence Detection.

Final rept.,

A. Fried, R. Sams, W. Dorko, J. Elkins, and Z. T. Cai. 1988, 10p
Pub. in Analytical Chemistry 60, n5 p394-403, 1 Mar 88.

Keywords: *Gas analyses, *Nitrogen dioxide, *Chemiluminescence, Comparison, Reprints, *Tunable diode laser absorption spectroscopy, Fourier transform spectroscopy.

Careful determination of the concentration of NO_2 in various compressed gas mixtures in the range between 2.3 - 2500 parts-per-million have been conducted by tunable diode laser absorption spectrometry and chemiluminescence detection. In one particular case,

the additional technique of Fourier transform infrared spectrometry was also employed in the analysis. Detailed intercomparisons of the results will be presented.

800,195

PB89-127567

PC A03/MF A01
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.

XRAYL: A Powder Diffraction Profile Refinement Program,

C. R. Hubbard, J. M. Stewart, Y. Zhang, B. Morosin, and E. L. Venturini. Oct 88, 37p NISTIR-88/3850
Prepared in cooperation with Maryland Univ., College Park. Dept. of Chemistry, and Sandia National Labs., Albuquerque, NM.

Keywords: *X ray diffraction, *Powder(Particles), *Mathematical models, *Spectrum analyzers, Separation, Tables(Data), Resolution, Fitting, Graphs(Charts), XRAYL computer code.

In many applications of x-ray powder diffraction in material studies, when overlap occurs it is necessary to separate the total (or composite) profile into its components. A computer program, XRAYL, has been developed to fit analytical functions to powder diffraction lines. After fitting, the powder diffraction data, given as counts at steps in 2θ , is represented diffraction line by diffraction line, by parameters of a profile function. The resulting profile parameters may then be used to generate 'idealized' powder diffraction lines, effectively free of statistical noise and contributions from overlapping lines, extending to background intensity on each side. Because of this capability XRAYL may be employed in x-ray powder diffraction profile analysis as a preprocessor program, that is, separating peaks and feeding the 'resolved' data to subsequent analysis programs. The NBS-IR contains: (1) profile functions and the nonlinear least-squares algorithm utilized in XRAYL; (2) user options and execution of the program; and (3) several examples.

800,196

PB89-131288

(Order as PB89-131254, PC A04)
National Bureau of Standards, Gaithersburg, MD.

Octacalcium Phosphate Solubility Product from 4 to 37 C,

M. S. Tung, N. Eidelman, B. Sieck, and W. E. Brown. 14 Apr 88, 11p

Prepared in cooperation with American Dental Association Health Foundation, Washington, DC.
Included in Jnl. of Research of the National Bureau of Standards, v93 n5 p613-624 Apr 88.

Keywords: *Solubility, *Calcium phosphate, *Tables(Data), Chemical equilibrium Hydrolysis, Bones, Teeth, *Octacalcium phosphate, *Solubility products.

Octacalcium phosphate (OCP) is proving to be an important intermediary in the formation of tooth and bone mineral and various pathological calcifications. Before this mineral can form, its solubility product must be exceeded. Thus, a knowledge of its precise values under various conditions is required for a basic understanding of calcification processes. The methodology suitable for measuring the solubility of metastable phases was developed and used to determine the negative logarithms of the solubility products of OCP, $\text{pK}/\text{sub sp}/(\text{OCP})$, at 4, 4.8, 6, 18, 23.5, and 37 deg C. The effects of (1) the use of different ionic models, (2) OCP hydrolysis, and (3) differences in equilibrium constants on the apparent $\text{pK}/\text{sub sp}/(\text{OCP})$ values are described; the latter two contribute significantly to the differences in $\text{pK}/\text{sub sp}/(\text{OCP})$.

800,197

PB89-132815

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Statistical Evaluation of Wavelength-Dispersive Digital Compositional Mapping with the Electron Microprobe.

Final rept.,

R. B. Marinenko, D. E. Newbury, R. L. Myklebust, and D. S. Bright. 1987, 3p
Pub. in Microbeam Analysis - 1987, p40-42.

Keywords: *Microanalysis, Spectrometers, Correction, Composition (Property), Mapping, Statistical analysis, Reprints, *Electron microprobe analysis, *Defocusing, Wavelength dispersive analysis.

Two different procedures are being used to correct for spectrometer defocusing when quantitating wave-

length dispersive digital maps taken with the electron microprobe. These are the Standard Map and Defocus Modelling procedures; the former uses an experimentally determined standard map to quantitate an unknown map, while the latter models a standard map for quantitation. Using homogeneous NBS Standard Reference Materials, the authors have statistically evaluated - for accuracy and precision - these two procedures. They have also evaluated the effect of the map size and time/pixel on the final result.

800,198

PB89-133383

(Order as PB89-133367, PC A04)
National Inst. of Standards and Technology, Boulder, CO.

Solvent-Free Injection in Supercritical Fluid Chromatography Using Sintered Glass Deposition,

T. J. Bruno. 27 Jul 88, 4p
Included in Jnl. of Research of the National Institute of Standards and Technology, v93 n6 p655-658 Jul 88.

Keywords: Injection, Glass, Equipment, Sampling, Chemical tests, *Supercritical fluid chromatography, Sintered materials.

Sample injection is supercritical fluid chromatography (SFC) is usually performed using a combination of apparatus from liquid chromatography and capillary gas chromatography. The device most often consists of an injection valve (of the type used in liquid chromatography) followed by a flow splitter controlled by a restrictor. It is sometimes desirable to inject samples in the absence of a solvent, as in physicochemical applications of SFC. In the article, two simple modifications to a conventional sampling valve are presented which allow solvent-free injection. Using these devices, sample (in a solvent) is deposited on a sintered glass bed. After removal of the solvent by mild heating and evacuation, the sample loop is filled with the supercritical carrier and the valve is switched to the inject position.

800,199

PB89-137541

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.

Basis for Quality Assurance of Chemical Measurements and Standards.

Final rept.,

R. A. Velapoldi, and H. S. Hertz. 1986, 26p
Pub. in The Importance of Chemical 'Speciation' in Environmental Processes, p685-710 1986.

Keywords: *Chemical analysis, Reliability, Accuracy, Precision, Quality assurance, Quality control, Standards, Reprints, Trace analysis, Ultratrace analysis.

The attainment of reliable accuracy and precision in chemical analyses at trace and ultratrace levels is difficult but can be obtained by implementation of a good quality assurance program and by designing and controlling the total analytical measurement process. Quality assurance, the steps in the total analytical measurement process, the impact of these steps on the determination of chemical species, and two case studies, which illustrate many of the requisite procedures to obtain reliable data, are discussed.

800,200

PB89-137616

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Checklist for Radioanalytical Quality Assurance.

Final rept.,

K. G. W. Inn. 1988, 19p
Pub. in Proceedings of Southwest ACS (American Chemical Society) Regional Meeting, Little Rock, AR., December 2-4, 1987, p515-533 1988.

Keywords: *Radioactivation analysis, Quality assurance, Quality control, Assessment, Evaluation, Reprints.

A checklist of items and concepts to be included in an assessment of a radioanalytical process is presented. Included are various features of quality assurance, quality control, and quality assessment. The primary aspects of a sound quality assurance program are: (1) documentation of all aspects of the Program; (2) validation and statistical control; and (3) periodic verification, inspection, and evaluation.

800,201
PB89-137624 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD, Ionizing Radiation Physics Div.
NBS (National Bureau of Standards) Work on Neutron Resonance Radiography.
 Final rept.,
 R. A. Schrack. 1988, 16p
 Pub. in Proceedings of Workshop on Neutron Resonance Radiography, Los Alamos, NM., July 27-29, 1987, p100-115 1988.

Keywords: *Neutron radiography, *Assaying, Resonance, Detectors, Samples, Nondestructive tests, Resolution, Sensitivity, Position(Location), Neutron counters, Radioactivation analysis, Isotopes, Reprints, Neutron Resonance Radiography, Position sensitive, Neutron time of flight.

The National Bureau of Standards (NBS) has been engaged in a wide-ranging program in neutron resonance radiography (NRR) using both one- and two-dimensional position-sensitive neutron detectors. The ability to perform a position-sensitive assay of up to 16 isotopes in a complex matrix has been demonstrated for a wide variety of sample types, including those with high-gamma activity. A major part of the program has been the development and application of the micro-channel-plate-based position-sensitive neutron detector. The detector system has high resolution and sensitivity, together with adequate speed of response to be used with neutron time-of-flight (TOF) techniques. The system has demonstrated the ability to image simultaneously three isotopes in a sample with no interference.

Basic & Synthetic Chemistry

800,202
PB88-167150 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD, Molecular Spectroscopy Div.
Intensities of Adsorption Lines of the Hot Band Nu sub 8 + Nu sub 11 - Nu sub 11 of Allene (12C3H4 (Intensites des Raies d'Absorption dans la Bande Chaude Nu sub 8 + Nu sub 11 - Nu sub 11 of de l'Allene (12C3H4).
 Final rept.,
 M. Dang-Nhu, and A. S. Pine. 1986, 8p
 Pub. in Canadian Jnl. of Physics 64, n3 p289-296 1986.

Keywords: *Allene, *Absorption spectra, Infrared spectroscopy, Reprints.

Strengths of individual lines of the hot band (nu sub 8) + (nu sub 11) - (nu sub 11) 12C3H4 at 3-micrometer have been measured with a high resolution difference frequency laser spectrometer. Finally two intensity parameters have been determined using a general formulation written for hot bands $E^+ X E^- < E^-$.

800,203
PB88-173992 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD, Chemical Thermodynamics Div.
Determination of Water Structure Around Biomolecules Using X-ray and Neutron Diffraction Methods.
 Final rept.,
 H. Savage, and A. Wlodawer. 1986, 22p
 Pub. in Methods in Enzymology 127, p162-183 1986.

Keywords: *Water, Proteins, Reprints, *Macromolecular structure, X-ray diffraction, Neutron diffraction, Hydrogen bonds.

The review summarizes current status of the models of solvent interactions with micromolecules. The models were obtained by the analysis of high resolution X-ray and neutron diffraction data for small biomolecules (amino acids, nucleotides), medium-sized biomolecules (vitamin B(12), cyclodextrin, antamamide), and proteins. Detailed interactions of solvent with macromolecules, disorder, alternate networks and replacement of water by other molecules were discussed. Strategy and requirements for a solvent analysis were proposed.

800,204
PB88-174008 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD, Chemical Thermodynamics Div.
Aluminum. II. Derivation of (C sub (v sub 0)) from (C sub p) and Comparison to (C sub (v sub 0)) Calculated from Anharmonic Models.

Final rept.,
 R. C. Shukla, C. A. Plint, and D. A. Ditmars. 1985, 16p
 Pub. in International Jnl. of Thermophysics 6, n5 p517-532 Sep 85.

Keywords: *Aluminum, Perturbation theory, Specific heat, Volume, Pressure, Mathematical models, Reprints.

The specific heat at constant pressure, (C sub 0), of aluminum measured by Ditmars, Plint, and Shukla has been reduced to the volume (V sub 0) appropriate for O K employing the Murnaghan equation. The (C sub (v sub 0)) thus obtained is compared with the theoretical (C sub (v sub 0)) calculated in the harmonic and the lowest order anharmonic approximation from three different pseudo-potentials (Harrison, Ashcroft and Dagens-Rasolt-Taylor) as well as a phenomenological Morse potential. The higher order (lambda sup 4) anharmonic contributions are calculated from the same nearest neighbor Morse potential as in the lowest order anharmonic theory. The role of the vacancy and the higher order anharmonic contributions to (C sub (v sub 0)) has been examined. Conclusions are cited.

800,205
PB88-174032 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD, Chemical Kinetics Div.
Oxidation of Iron (III) - Porphyrins by Peroxyl Radicals Derived from 2-Propanol and Methanol-Evidence for Acid Dependent and Acid Independent Pathways.
 Final rept.,
 P. Neta, and D. Brault. 1985, 5p
 Pub. in Chemical Physics Letters 121, n1-2 p28-32 1985.

Keywords: *Radiolysis, Carbinols, Propanols, Oxidation, Acidity, pH control, Reprints, *Iron/((deuteroporphyrin)dimethyl-ester), Peroxyl radicals, Methanol, Aqueous solutions.

(3/Iron) deuteroporphyrin dimethyl ester is oxidized to the radical cation form by the peroxyl radicals CH2(OH)O2 and (CH3)2C(OH))2. generated by pulse radiolysis of air saturated aqueous solutions of methanol and 2-propanol, respectively. Oxidation by CH2(OH)O2 radicals proceeds with k = 10 million/M/ S independent pH. In contrast, the electron transfer reaction of (CH3)2C(OH)O2 is pH dependent. A reaction scheme, which may apply to all peroxyl radicals depending on relative rate constants, is proposed. It involves the formation of an iron porphyrin peroxyl radical adduct which decays by acid dependent and acid dependent routes.

800,206
PB88-174065 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD, Chemical Kinetics Div.
Ion Chemistry of Cyanides and Isocyanides. 2. Alkylation of HCN and Cyanides by Oxygen and Sulfur Compounds. Gas-Phase Synthesis and Reactions of Protonated Isocyanides.
 Final rept.,
 M. Mautner, and Z. Karpas. 1986, 5p
 See also AD-A181 189.
 Pub. in Jnl. of Physical Chemistry 90, n10 p2206-2210 1986.

Keywords: *Cyanides, *Isocyanides, *Alkylation, Alcohols, Oxygen, Protons, Chemical reactions, Reprints, *Vapor phases, Sulfur compounds.

The reaction: ROH2(+) + HCN --> RNCH(+) + H2O is observed in mixtures containing alcohols and HCN. Proton affinity bracketing experiments show that the products are protonated isocyanides, RNCH(+), which are formed by alkylation of the nitrogen in HCN, rather than protonated isocyanides, RCNH(+). Although the latter are more stable, their production would require rearrangement. Similar reactions are observed between (CH3)2OH(+) and RSH2(+) and HCN. CH3CN and HC3N (cyanoacetylene) can also be alkylated in similar fashion to form the nitrilium ions CH3CNCH3(+) and HC3NCH3(+), respectively. The rate constants are given.

800,207
PB88-174099 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD, Chemical Kinetics Div.
Formation and Decay of Zinc Tetrakis (N-methyl-3-pyridyl) Porphine pi-Radical Cation in Water.
 Final rept.,
 M. C. Richoux, P. Neta, P. A. Christensen, and A. Harriman. 1986, 15p
 Pub. in Jnl. of the Chemical Society, Faraday Transactions 2, v82 n2 p235-249 1986.

Keywords: Reprints, *Zinc porphyrin, *Radical cation, Pulse radiolysis, Decay kinetics.

Zinc meso tetrakis (N-methyl-3-pyridyl) porphine (ZnTMPyP(3)(4+)) is readily oxidized to the pi-radical cation under pulse radiolytic ((KFr) = 10(-2) mol dm(-3)) or photochemical ((S(2)O(8)2-) = 10(-3) mol dm(-3)) conditions. The pi-radical cation undergoes bimolecular disproportionation to form a porphyrin pi-dication which reacts with hydroxide ions to form an isoporphyrin (pH < 7) or a 5,6-dihydroxyporphyrin (pH > 7). This disproportionation reaction can be catalysed by colloidal RuO(2). 2H(2)O and Prussian Blue but, at pH > 7, the catalysed reaction leads to competitive formation of a ring-opened product. Photolysis (lambda > 420 nm) of ZnTMPyP(3)(4+) in water containing persulphate and catalyst does not result in generation of detectable amounts of O(2).

800,208
PB88-174107 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD, Chemical Kinetics Div.
Flow ESR (Electron Spin Resonance) and Static Studies of the Decomposition of Phenyl Substituted Ethanes.
 Final rept.,
 M. J. Manka, R. L. Brown, and S. E. Stein. 1985, 7p
 Pub. in Jnl. of Physical Chemistry 89, n25 p5421-5427 1985.

Keywords: *Electron paramagnetic resonance, Pyrolysis, Chemical bonds, Reaction kinetics, Reprints, *Tetraphenyls, *Tetraphenylethane, Thermal decomposition.

The thermal decomposition of 1,1,2,2-tetraphenylethane (DD) was studied in high temperature fluids using both sealed tube and flow ESR techniques.

800,209
PB88-174925 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD, Chemical Kinetics Div.
Pathways to Graphite: Properties of Very Large Polybenzenoid.
 Final rept.,
 S. E. Stein, and R. L. Brown. 1987, 30p
 Pub. in Mol. Struct. Energetics 2, p37-66 1987.

Keywords: *Benzene, *Aromatic hydrocarbons, *Hydrocarbons, Chemical bonds, Molecular structure, Graphite, Reprints, Electron energy.

The electronic properties of large polybenzenoid hydrocarbons were analyzed using theories that require only counts of resonance structures as input. Stabilities were calculated as a function of edge-type for four homologous series of molecules containing up to 16,000 carbon atoms. In addition, bond orders, ring aromaticities and electron localization energies were examined. The work provides a basis for studying the influence of edge structure and relative position on the chemistry of such molecules. It is intended to provide a logical background for future calculations employing more sophisticated theories.

800,210
PB88-176581 Not available NTIS
 National Bureau of Standards (NML), Washington, DC, Molecular Spectroscopy Div.
Does Ammonia Hydrogen Bond.
 Final rept.,
 D. D. Nelson, G. T. Fraser, and W. Klemperer. 1987, 5p
 Pub. in Science 238, p1670-1674, 18 Dec 87.

Keywords: *Ammonia, Reprints, *Dimers, *Complex, Hydrogen bonding, Microwave spectroscopy, Van der Waals molecules.

Spectroscopic characterizations of the stereochemistry of complexes of ammonia (NH3) have strongly confirmed some long-held ideas about the weak interactions of NH3 while casting doubt on others. As ex-

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pected, NH₃ is observed to be a nearly universal proton acceptor, accepting hydrogen bonds from even some of the weakest proton donors. Surprisingly, no evidence has been found to support the view that NH₃ acts as a proton donor through hydrogen bonding. A critical evaluation of the work that has been done to gather such evidence, as well as of earlier work involving condensed-phase observations, suggests that NH₃ might well be best described as a powerful hydrogen-bond acceptor with little propensity to donate hydrogen bonds.

800,211
PB88-176730 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Neutron Spectroscopic Evidence for Subsurface Hydrogen in Palladium.

Final rept.,
J. M. Nicol, J. J. Rush, and R. D. Kelley. 1987, 3p
Sponsored by Maryland Univ., College Park. Dept. of Physics, and Department of Energy, Washington, DC.
Pub. in *Physical Review B* 36, n17 p9315-9317, 15 Dec 87.

Keywords: *Adsorption, *Hydrogen, Reprints, *Neutron inelastic scattering, *Palladium black, Subsurface, Vibrational spectroscopy.

The interaction of hydrogen with palladium black, a high-surface-area metal powder, has been investigated by incoherent inelastic neutron scattering. The vibrational spectrum associated with chemisorbed surface hydrogen occupying threefold sites has been identified. A vibrational mode at 58 meV, which is found to be inconsistent with either surface or bulk palladium-hydrogen species, is assigned to chemisorbed hydrogen occupying subsurface sites.

800,212
PB88-176763 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Time-Domain Measurements of Vibrational Relaxation at Surfaces: CO(V=1) in Metal Carbonyl Systems.

Final rept.,
R. R. Cavanagh, E. J. Heilwell, and J. C. Stephenson. 1987, 10p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in *Jnl. of Electron Spectroscopy and Related Phenomena* 45, p31-40 1987.

Keywords: *Carbon monoxide, *Lasers, Reprints, *Metal clusters, Picoseconds, Platinum, Rhodium, Silicon oxide, Vibrational relaxation.

A picosecond infrared pump-probe technique has been used to measure the CO(V=1) vibrational relaxation rates for a series of metal carbonyls dilute in CHCl₃ and supported on SiO₂. T₁ times are in the range 130-700 ps for (Rh(CO)₂Cl)₂, Co₄(CO)₁₂, Rh₄(CO)₁₂ and Rh₆(CO)₁₆ in solution, and for (Rh(CO)₂Cl)₂ and Rh₄(CO)₁₂ on SiO₂; in these systems vibrational damping occurs by energy transfer to lower frequency modes. For CO chemisorbed on dispersed Pt particles on SiO₂, T₁ is reduced (T₁ < or - the 18 ps laser pulse width), and may indicate the appearance of an electron-hole pair damping mechanism. Wavelength dependent transient bleaching and transient absorptions are documented and are attributed to first and higher excited state populations respectively.

800,213
PB88-176870 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Rotationally Resolved LIF Study of the N₂(1+) Products of the Thermal Energy Penning Ionization Reaction: Ne*(triplet P₂) + N₂.

Final rept.,
D. M. Sonnenfroh, and S. R. Leone. 1987, 3p
Grants NSF-CHE84-08043, NSF-CHE86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in *Jnl. of Chemical Physics* 87, n8 p5041-5043, 15 Oct 87.

Keywords: Nitrogen, Reaction dynamics, Rotation, Reprints, *Penning ionization, *Neon.

Bimodal rotational distributions are observed in the N₂⁺ products of the Penning ionization of N₂ by Ne*(3P₂). The N₂⁺ rotational distributions are well fit

by a two component Boltzmann distribution having a low temperature of 50 K plus or minus 10 K and a high temperature ranging from 220 to 490 K plus or minus 50 K. The relative contribution of each component varies smoothly with vibrational level from 62% T(low): 38% T(high) for v=0 to 43 T(low): 57 T(high) for v=4 (with errors of plus or minus 2%). The authors interpret the observed bimodal rotational distributions as evidence for multiple entrance channels which arise when the five-fold degeneracy of the asymptotic reactant surface is lifted as the reactants approach. The degree of rotational excitation is successfully modeled by hard sphere collisions with an ellipsoidal potential of different ellipticity for each channel. Since the degree of rotational excitation in each channel is small, observation of the bimodality requires suppression of the reactant initial rotation by using a supersonic molecular beam.

800,214
PB88-177449 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

3p(6)3d(9)-3p(5)3d(10) Transitions of Cobaltlike Ions from Sr(11+) to U(65+).

Final rept.,
J. O. Ekberg, U. Feldman, J. F. Seely, C. M. Brown, and J. Reader. 1987, 6p
See also PB84-105667. Sponsored by Department of Energy, Washington, DC. Office of Magnetic Fusion Energy, and Naval Research Lab., Washington, DC.
Pub. in *Jnl. of the Optical Society of America B* 4, n12 p1913-1918 Dec 87.

Keywords: Reprints, *Cobaltlike ions, *Relativistic calculations, Spectra, Vacuum ultraviolet wavelengths.

The 3p(6)3d(9)(2)D-3p(5)3d(10)(2)P transitions of the Co-like ions Ru(17+)-Sb(24+), Sm(35+), Eu(36+), Gd(37+), Yb(43+), and Au(52+) were excited with laser-produced plasmas and photographed with grazing-incidence spectrographs. The observed wavelengths of the 2D(5/2)-2P(3/2) and 2D(3/2)-2P(1/2) transitions were compared with relativistically calculated ab initio wavelengths and, by fitting the differences between the observed and calculated wave numbers to simple formulas, least-squares fitted wavelengths were obtained for all ions from Sr(11+) to U(65+). The wavelengths range from 8 to 93A. The estimated uncertainty of the fitted wavelengths is + or - 0.005A, which makes them useful as reference values. Smoothed values of the energy levels were derived from the fitted values of the wavelengths and 3p(6)3d(9)(2)D fine-structure intervals. Wavelengths for the 3p(6)3d(9)(2)D(3/2)-3p(5)3d(10)(2)P(3/2) transitions and the 3p(6)3d(9)(2)D(5/2)-(2)D(3/2) magnetic-dipole transitions were derived from the smoothed energy-level values.

800,215
PB88-177464 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Comment on Collisional Broadening of the H(alpha) Line in Dense Plasmas.

Final rept.,
D. H. Oza, and R. L. Greene. 1988, 4p
Grant NSF-PHY85-19371
Sponsored by National Science Foundation, Washington, DC.
Pub. in *Jnl. of Physics B: At. Mol. Opt. Phys.* 21, pL5-L8 1988.

Keywords: Interference, *Balmer alpha, *Density dependence, Dynamic ions, Half widths, Hydrogen radiation.

Experimental results for the collisionally broadened Balmer alpha line in dense argon plasmas have recently been reported which deviate significantly from the earlier theoretical results. We have performed ab initio theoretical calculations at the experimental plasma conditions. The inclusion of time ordering in the electron operator (neglected in previous calculations) brings the theoretical and experimental results into agreement. The authors comment on the procedure adopted by Vitel for the extrapolation of theoretical results from lower electron densities to the experimental values.

800,216
PB88-177472 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Additions and Revisions to the Levels of Magnetiumlike Cu XVIII and Zn XIX.

Final rept.,
J. Sugar, and V. Kaufman. 1987, 2p
Pub. in *Jnl. of the Optical Society of America B* 4, p2010-2011 Dec 87.

Keywords: Reprints, *Zinc, *Copper, Energy levels, Parameters, Wavelengths.

Energy-level values are given for the 3p(2)(1)S₀ and 3p3d(1)F₃ and (1)P₁ states of CuXVIII and Zn XIX. Corrections to the published wavelengths for these spectra found from new observations are reported.

800,217
PB88-178496 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Neutron Scattering Studies of Hydrogen in Catalysts.

Final rept.,
T. J. Udovic, and R. D. Kelley. 1988, 16p
Sponsored by Department of Energy, Washington, DC.
Pub. in *Hydrogen Effects in Catalysis--Fundamentals and Practical Applications*, Chapter 6, p167-182 1988.

Keywords: *Adsorption, *Catalysis, Hydrogen, Reprints, *Chemisorption, Diffraction, Neutron scattering, Quasielastic scattering, Vibrational spectroscopy.

Neutron scattering studies of hydrogen in catalysts are reviewed. Techniques applicable to catalysis studies; namely, incoherent inelastic neutron scattering (IINS), quasielastic neutron scattering (QNS), and powder neutron diffraction; are introduced. Selected examples are presented with an emphasis on illustrating the utility of these neutron scattering techniques for probing the vibrational, diffusive, chemical, and structural behavior of hydrogen on catalyst surfaces.

800,218
PB88-178504 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Molecular Dynamics Study of Intercollisional Interference in Collision-Induced Absorption in Compressed Fluids.

Final rept.,
R. Mountain, and G. Birnbaum. 1987, 9p
Pub. in *Jnl. of the Chemical Society, Faraday Transactions 2*, v83 n10 p1791-1799 1987.

Keywords: *Helium, Reprints, *Collision induced absorptions, Collisional interference, *FIR absorption, Fundamental vibrations band.

When the induced dipole microns(R) is predominantly due to isotropic overlap interaction, the translational collision-induced absorption exhibits a pronounced dip in the spectral density around zero frequency at high densities. This dip is observed in the far-infrared spectrum of rare-gas mixtures and in the Q-branch of the fundamental band of dilute H₂ in He. The far-infrared spectrum of Kr in liquid Ar and the fundamental vibrational band of gaseous H₂ in He at 300K, 1150 amagat were obtained by molecular dynamics (MD) calculations with the assumption of pairwise interactions in microns(R) and the potential V(R). Reliable pair induced-dipole and potential models derived from studies of the low-density gas were employed. Although the MD results are in rather poor agreement with the experiment for the Ar-Kr mixture, much better agreement is obtained for the He-H₂ mixture. A reason for this result is advanced. The destructive interference of microns(R) in successive collisions and the resulting large cancellation of spectral intensity makes this phenomenon a particularly sensitive probe of molecular interactions. The conceivable role of many-body effects associated with irreducible three-body terms in the dipole moment and potential energy is discussed.

800,219
PB88-187513 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Laser Probing of the Rotational Alignment of N₂(1+) Drifted in Helium.

Final rept.,
R. A. Dressler, H. Meyer, and S. R. Leone. 1987, 11p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and National Science Foundation, Washington, DC.
Pub. in *Jnl. of Chemical Physics* 87, n10 p6029-6039, 15 Nov 87.

Keywords: Reprints, *Alignment, *Drift tube, *Glowing afterglow, Laser mobility, Nitrogen ion.

Results are presented on laser-induced fluorescence studies of the rotational alignment of $N_2(1+)$ drifted in helium. The alignment which is caused by collisions of the ions with the helium buffer gas is observed in the uniform electric field of a drift tube. The angular momentum vectors of the ions are preferentially aligned perpendicular to the electric field vector. At a drift field of 14 Td, corresponding to a collision energy of 52 meV (c.m.), a quadrupole moment $AO(2) = -0.11$ plus or minus 0.03 is determined for the $N=10$ rotational state. This yields an approximate population ratio of 2:3 for finding molecules with rotational angular momentum vectors parallel and perpendicular to the electric field vector, respectively. In addition to the alignment studies, a detailed characterization of the drift tube using laser-induced fluorescence detection of $N_2(1+)$ is presented. Theoretical results for the determination of alignment parameters using saturated laser-induced fluorescence are presented.

800,220
PB88-187521 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Effects of Isotopic Substitution on Abstraction Reactions of Ammonia Ions with Hydrogen at Very Low Temperatures.

Final rept.,
S. E. Barlow, and G. H. Dunn. 1987, 11p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in International Jnl. of Mass Spectrometry and Ion Processes 80, p227-237 1987.

Keywords: Reprints, *Abstraction, *Ammonia ions, Ion molecule reactions, Isotope dependence, Ultralow temperature.

The reaction rate coefficients for $NH_3(+)$ reacting with D_2 and $NH_3(+)$ reacting with H_2 and D_2 have been measured at temperatures at a range between 10 and 20 K. When these measurements are taken in concert with earlier measurements of these reactions at higher temperatures and with the temperature-dependent measurements of the reactions of $NH_3(+)$ with H_2 , a pattern suggestive of a quantum mechanical tunnelling mechanism emerges for low-temperature reactions. Other observations in the work lead us to conclude that the reactions in the temperature range can be attributed entirely to the abstraction process: no exchange products were observed.

800,221
PB88-189204 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Review of Electrolytic Conductance Standards.
Final rept.,
Y. C. Wu, W. F. Koch, W. J. Hamer, and R. L. Kay. 1987, 13p
Pub. in Jnl. of Solution Chemistry 16, n12 p985-997 1987.

Keywords: Standards, Temperature scale, Resistivity, Resistance, Reprints, *Aqueous solution, Cell constant, Conductance, *Electrolytic conductivity, Potassium chloride.

Measurements of aqueous electrolytic conductance are performed routinely in a variety of disciplines and industries. Conductivity is a measure of the ionic content in solution and thus has applications in pharmaceuticals, power plants, rainwater, lake surveys, and oceanography, to name a few. A thorough review of the measurement of and standards for aqueous electrolytic conductance is herein presented. At present, the most precise and accurate standards have been set forth by the International Organization of Legal Metrology (OIML), and have been adopted by most other standard organizations. However, the uncertainty assigned to these standards, especially the secondary standards, is somewhat larger than would be expected from the physical aspects of the measurement. Several changes in the units and measurement scales, including temperature, volume, molar mass, resistance, and concentration obfuscate the accuracy of these standards. In addition to the review, research is proposed, using a conductance cell with variable length, to establish new standards for aqueous electrolytic conductance.

800,222
PB88-189535 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Thermodynamic Databases in the U.S. National Standard Reference Data System.

Final rept.,
H. J. White. 1985, 4p
Pub. in CODATA (Committee on Data for Science and Technology) Bulletin No. 58, p45-48 Nov 85.

Keywords: Reviews, Reprints, Automated data bases, Automation, *National Standard Reference Data System, *Thermodynamic data.

In the last several years, automated data bases containing critically evaluated thermodynamic data have begun to become available. Automated bases associated with the activities of the Office of Standard Reference Data of the U.S. National Bureau of Standards will be described briefly and plans for further developments will be reviewed.

800,223
PB88-189824 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Bimodal Rotational Distributions of $N_2(1+)$ Produced in the Thermal Energy Penning Ionization of N_2 by $Ne^*((3)P_2)$.

Final rept.,
D. M. Sonnenfroh, and S. R. Leone. 1987, 20p
Grants NSF-CHE86-16628, NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in International Jnl. of Mass Spectrometry and Ion Processes 80, p63-82 1987.

Keywords: *Nitrogen, *Neon, Rotation, Vibration, Reprints, *Penning ionization, Alignment effects.

The thermal energy Penning ionization of N_2 by $Ne^*((3)P_2)$ is studied by laser-induced fluorescence probing of the $N_2(1+)$ products under single-collision conditions. Bimodal rotational distributions are observed in each vibrational state. The rotational populations can be fit by a two-component Boltzmann distribution having a low temperature between 45 and 60 K + or - 10 K and a high temperature between 220 and 490 K + or - 50 K. Several mechanisms are presented to account for the observed bimodal rotational distributions. The most intriguing involves possible dynamical effects of the structure known to exist in the repulsive wall of the entrance surface. This structure may make possible ionizing transitions to two distinct regions of the exit surface resulting in collisions of different inelasticity with the repulsive wall of that surface. The vibrational results confirm the essential Franck-Condon nature of the Penning ionization process. In contrast, the rotational results provide a valuable extension to the traditional Penning ionization model for repulsive systems.

800,224
PB88-189873 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Chemical Engineering Science Div.

Helium Adsorption on Activated Carbons at Temperatures between 4 and 76 K.

Final rept.,
I. Vazquez, M. P. Russell, D. R. Smith, and R. Radebaugh. 1988, 9p
Sponsored by Air Force Space Technology Center, Kirtland AFB, NM.
Pub. in Advances in Cryogenic Engineering, v33 p1013-1021 1988.

Keywords: Adsorption, Compressors, Correlation, Cryogenic, Reprints, *Activated carbon, *Heat of adsorption, *Helium.

Helium adsorption isotherms have been measured for two activated carbons in the 4-76 K temperature range for pressures from 0.1 to 3000 kPa. Such measurements have not been made previously in the temperature and pressure range, but they are needed for the design of an adsorption compressor for helium gas. The paper describes the measurement and analysis techniques for obtaining the adsorption isotherms. The isosteric heats of adsorption are derived from these isotherms. Adsorption isotherms on various charcoals are correlated using the effective adsorbed film thickness as a fundamental parameter.

800,225
PB88-192232 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Ethane Hydrogenolysis Catalyzed by W(100).

Final rept.,
M. J. Wax, R. D. Kelley, and T. E. Madey. 1986, 4p
Pub. in Jnl. of Catalysis 98, n2 p487-490 1986.

Keywords: Reprints, Catalysis, Catalytic reforming, *Hydrogenolysis, *Tungsten, Tungsten carbide.

The ability of the (100) face of tungsten to catalyze ethane hydrogenolysis has been investigated. At 573 K, methane is formed with a specific activity of 0.01 molecules per surface tungsten atom per second (100 Torr H_2 , 1 Torr C_2H_6), with no evidence of catalyst deactivation even after several hundred turnovers. Hydrogenolysis is approximately first-order in ethane and half-order in dihydrogen, and displays an apparent activation energy of 27 kcal/mol. Negligible activity is displayed by clean tungsten; the true catalyst appears to be a monolayer of carbide which is formed on the surface of the tungsten upon exposure to the reactants.

800,226
PB88-194550 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Development of Standards for Surface Analysis.

Final rept.,
C. J. Powell. 1988, 2p
Pub. in Surface and Interface Analysis 11, p103-109 1988.

Keywords: *Surface analysis, Standards, Reprints, ASTM Committee E-42, IUPAC Working Group.

As the use of surface analysis increases, the need for standards (reference procedures, reference data, and reference materials) becomes more urgent. The article describes recent activities and current plans of three organizations that are active in developing standards for surface analysis: Committee E-42 on Surface Analysis of the American Society for Testing and Materials; the Surface Chemical Analysis Working Party of the Versailles Project on Advanced Materials and Standards (VAMAS); and the Working Group on Surface Analysis of the International Union of Pure and Applied Chemistry.

800,227
PB88-194873 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Recent Advances in the Characterization of Bonded Phases.

Final rept.,
L. C. Sander, C. J. Glinka, and S. A. Wise. 1985, 15p
Pub. in Silanes, Surfaces, and Interfaces, p431-445 1985.

Keywords: Characterization, Density, Surface area, Reprints, *Bonded phase sorbents, *Contrast variation, Pore masking, Pore volume, Small angle neutron scattering.

The applicability of nitrogen adsorption surface area measurements to bonded phase sorbents is investigated for a variety of phase types. The apparent surface area values for the substrates decrease as a function of overall carbon loading. Trends in sorbent density and pore volume are also examined. The technique of small angle neutron scattering (SANS) is used to evaluate surface area and pore diameter of silica substrates. Pore masking experiments with SANS are used to probe pore accessibility, and the applicability of the technique to study bonded phases is described.

800,228
PB88-195011 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Fire Measurement and Research Div.
Temperature Measurements in PMMA (Poly(methylmethacrylate)) during Downward Flame Spread in Air Using Holographic Interferometry.

Final rept.,
A. Ito, and T. Kashiwagi. 1986, 10p
Pub. in Proceedings of International Symposium on Combustion (21st), Combustion Institute, Munich, West Germany, August 3-8, 1986, p65-74.

Keywords: *Heat transfer, Temperature, Conductive heat transfer, Convective heat transfer, *Flame spread, Holographic interferometry, Poly(methylmethacrylate).

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Temperature distributions within a thermally thick cast slab of poly(methylmethacrylate) (PMMA) during downward flame spread in air were determined by measurements of changes in refractive index of PMMA using a holographic interferometry technique. The surface temperature history was measured with a fine thermocouple as a reference for the interferogram over the glass transition region. Samples with widths of 0.32, 0.47 and 1.0 cm and thicknesses of 1.5 and 2.5 cm were used. The experimental configuration was arranged to make the phenomena two-dimensional in the direction of the laser beam. Detailed temperature and heat flux profiles, especially in the area of the immediate vicinity of the flame foot, were obtained. The results indicate that the surface temperature increases gradually from about 1 cm ahead of the vaporization front and reaches the glass transition temperature about 0.2 cm ahead of the vaporization front. Then, it sharply increases to the vaporization temperature, about 380 deg C. The visible flame front extends about 0.1 cm ahead of the vaporization front.

800,229

PB88-198981

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Phase Extension by Combined Entropy Maximization and Solvent Flattening.

Final rept.,

E. Prince, L. Sjolin, and R. Alenljung. 1988, 7p
Pub. in *Acta Cryst. A* 44, p216-222 1988.

Keywords: *Molecular structure, *Proteins, Algorithms, Entropy, Reprints, *Ribonuclease A, Macromolecular systems.

An efficient algorithm is described for finding the maximum entropy density distribution. This algorithm is combined with solvent flattening in a procedure for extending phases to higher resolution. A test of the procedure on the structure of ribonuclease A and its application to the determination of two previously unknown structures are discussed.

800,230

PB88-217252

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Pure Rotational Spectrum of ArH(1+).

Final rept.,

J. M. Brown, D. A. Jennings, M. Vanek, L. R. Zink, and K. M. Evenson. 1988, 3p

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in *Jnl. of Molecular Spectroscopy* 128, p587-589 1988.

Keywords: *Rotational spectra, Molecular spectroscopy, Vibrational spectra, Reprints, *Arsenic hydride, Rotational constants.

Six rotational frequencies of the ArH⁺ ground state ($v=0$) were measured with a tunable far-infrared spectrometer. These data along with previous results from other workers yield molecular constants for ArH⁺ which are improved by up to an order of magnitude.

800,231

PB88-212728

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.

Heat Transfer Problem for the Modified Chemical Vapor Deposition Process.

Final rept.,

M. Choi, H. R. Baum, and R. Greif. 1987, 5p
Pub. in *Jnl. of Heat Transfer* 109, p642-646 Aug 87.

Keywords: *Heat transfer, *Vapor deposition, Crystal growth, Reprints, *Chemical vapor deposition, Temperature profiles.

The heat transfer problem related to the modified chemical vapor deposition process has been analyzed in the high Peclet number limit. Variations in the axial, angular, and radial directions are presented. Of particular interest are the effects of tube rotation and variable properties on the temperature profiles.

800,232

PB88-217559

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Global Phase Behavior of Mixtures of Short and Long n-Alkanes.

Final rept.,

C. J. Peters, J. de Swaan Arons, J. M. H. Levelt Sengers, and J. S. Gallagher. 1988, 6p
Pub. in *AIChE Jnl.* 34, n5 p834-839 May 88.

Keywords: *Alkanes, Hydrocarbons, Reprints, *Vapor liquid equilibria.

The perturbed-hard-chain model of Beret, Donohue, and Prausnitz, in the simplified version of Kim et al., is compared with recent VLE data on mixtures of ethane and n-alkanes with carbon numbers from 16 to 24. By using and extrapolating the linear relations between the three adjustable model parameters and the carbon number, as given by Kim et al., the authors find that the experimental isothermal bubble curves are well represented up to the critical pressure without the use of any adjustable parameters. Experimental Henry constants for ethane in eicosane are well predicted at all temperatures. The authors found that the global model is more accurate than the Soave-Redlich-Kwong equation, even if the latter is fitted isotherm-by-isotherm to individual mixtures with temperature-dependent mixing parameters.

800,233

PB88-218011

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Neutral Radical Deposition from Silane Discharges.

Final rept.,

A. Gallagher. 1988, 8p
Sponsored by Solar Energy Research Inst., Golden, CO.

Pub. in *Jnl. of Applied Physics* 63, n7 p2406-2413, 1 Apr 88.

Keywords: *Silane, Free radicals, Reprints, *Amorphous silicon, Silicon solar cells.

The fractional contributions of the various SiH(n) radicals ($n=0-3$) to deposition are calculated for low-power, pure-silane rf and dc discharges. This is done using a radical diffusion plus reaction equation, combined with current knowledge of SiH₄ dissociation fractionation, of SiH(n) + SiH₄ reactions, and of the distributed source of radicals. The conclusion reached is that more than 98% of neutral radical deposition is by SiH₃ for typical deposition pressures (> 100 mT at 240 C). The effect of SiH₃ + SiH₃ reactions at higher power is also evaluated using an estimated reaction rate coefficient ($k(3)$). The resulting loss in deposition rate is given as a function of film growth rate and of $k(3)$.

800,234

PB88-246756

(Order as PB88-246707, PC A04)

National Bureau of Standards, Gaithersburg, MD.

Precipitation of NH₄UO₂PO₄·3H₂O- Solubility and Structural Comparison with Alkali Uranyl(2+) Phosphates.

M. Markovic, N. Pavkovic, and N. D. Pavkovic. 4 Apr 88, 7p

Included in *Jnl. of Research of the National Bureau of Standards*, v93 n4 p557-563 1988.

Keywords: Tetragonal lattices, Alkali metal compounds, Precipitation(Chemistry), X ray diffraction, Crystal structure, Solubility, Comparison, Hydrates, *Ammonium uranyl phosphates.

Precipitates formed in the system UO₂(NO₃)₂·NH₄OH-H₃PO₄-H₂O, aged for 30 days at 298 K, were studied. The precipitates were characterized by chemical and thermogravimetric analyses, x-ray powder diffraction, infrared spectroscopy, polarized light microscopy, and by their fluorescent properties. The precipitation boundary was established titrimetrically and microscopically. On the basis of these measurements, the stability conditions, structural parameters and solubility of the tetragonal polymorph of NH₄(UO₂PO₄)·3H₂O were determined.

800,235

PB89-127138

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Addition and Cycloaddition Reactions of Tetracyanoethylene (TCNE) in Organic Chemistry.

Final rept.,

A. J. Fatiadi. 1987, 41p
Pub. in *Synthesis*, n9 p749-789 1987.

Keywords: *Synthesis(Chemistry), *Addition reactions, *Cyclization, Reprints, *Ethylene/tetracyano.

The present review is mainly concerned with selected addition and cycloaddition reactions of tetracyanoethylene that have use or potential use in organic synthesis. Emphasis has been laid on recent developments in (2+2) cycloadditions, the Diels-Alder reaction, the ene reaction, and higher-order cycloadditions of TCNE to carbocyclic and heterocyclic substrates. Also, the mechanistic aspects, and recent developments in thermal and photocycloaddition reactions are discussed.

Industrial Chemistry & Chemical Process Engineering

800,236

PB88-164272

PC A05/MF A01

National Bureau of Standards (NEL), Boulder, CO. Center for Chemical Engineering.

Center for Chemical Engineering Technical Activities: Fiscal Year 1987.

Research summary Oct 86-Sep 87, J. Hord. Feb 88, 84p NBSIR-87/3079
See also report for 1986, PB87-165155.

Keywords: *Chemical engineering, *Research projects, Fluid mechanics, Thermophysical properties, Calibrating, Measurement.

Technical research activities performed by the Center for Chemical Engineering during the Fiscal Year 1987 are summarized herein. These activities fall within the general categories of process measurement, thermophysical properties data, and chemical engineering science. The authors embody: development and improvement of measurement principles, measurement standards, and calibration services such as volumetric and mass flow rates, liquid volume, liquid density, and humidity; generation (via accurate measurement and advanced predictive models) of reliable reference data for thermophysical properties of pure fluids, fluid mixtures, and solids of vital interest to industry; and development of improved correlations, models, and measurement techniques for complex flows, heat and mass transport, mixing, and chemically reacting flows of interest in modern unit operations.

800,237

PB88-174016

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Aqueous Solubilities and Enthalpies of Solution of n-Alkylbenzenes.

Final rept.,

J. W. Owens, S. P. Wasik, and H. DeVoe. 1986, 5p
Pub. in *Jnl. of Chem. Eng. Data* 31, n1 p47-51 1986.

Keywords: *Aromatic monocyclic hydrocarbons, *Ethyl benzene, *Solubility, Enthalpy, Free energy, Automation, Hydration, Entropy, Reprints, *Aqueous solutions, Liquid column chromatography.

Aqueous solubilities of a homologous series of five liquid n-alkylbenzenes, ethylbenzene through n-hexylbenzene, were measured in the range of 10-45 degrees with an automated coupled-column liquid chromatography apparatus. Standard molar free energies, enthalpies, and heat capacity changes for the solution process were evaluated by the method of Clarke and Glew, and used to calculate the corresponding quantities for the hydration process ($g \rightarrow aq$). The methylene increments for free energy, enthalpy, and entropy of hydration in the series are close to those that have been determined for n-alkanes.

800,238

PB88-187679

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Residence Time Distributions for Free Convection in Packed Beds.

Final rept.,

M. C. Jones, K. Y. Gahghager, and H. R. Feuerherm. 1987, 21p

Sponsored by Colorado School of Mines, Golden. Pub. in *Chemical Engineering Communications* 57, p167-187 1987.

Keywords: Reprints, *Free convection, *Packed beds, Residence time distribution, Tracer response.

Experimental tracer pulse responses were recorded for a laboratory simulation of a fixed-bed reactor. The simulation consisted of a packed bed fitted with an electrical heater and supplied with a gas throughflow. Radically different responses were observed depending on whether the bed was undergoing free convection or not as inferred from the calculated Rayleigh number. For the free-convection cases, the response was characterized by a large early peak followed by a second smaller peak in contrast to the single broad peak characteristic of dispersed plug flow. Interpretation of the experimental results was obtained from numerical calculations of the Residence Time Distribution (RTD) and resulting plots of steady state stream function and concentration contours for different times after injection of the pulse. The successive peaks were seen to arise from the rotation of a high-concentration zone around a convection cell. The time between peaks is thus the mean circulation time of the convection cell. The method is rapid to use and allows immediate determination of the convecting state of a packed bed. It should be possible to use it for the verification of theoretical results, particularly for stability limits.

800,239
PB88-189774 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
High Resolution SIMS and Neutron Depth Profiling of Boron Through Oxide-Silicon Interfaces.
Final rept.,
W. Vandervorst, F. R. Shepherd, and R. G. Downing. 1985, 4p
Sponsored by Bell Northern Research Ltd., Ottawa (Ontario).
Pub. in Jnl. of Vacuum Science and Technology A 3, n3 p1318-1321 1985.

Keywords: Implantation, Interface, Reprints, Annealing, Boron, Charged particle reactions, *Semiconductor material, *Silicon, Thin films.

SIMS and Neutron depth profiling (NDP) have been used to study the distribution of $^{10}\text{B}^+$ implanted into Si through thermal oxide, and its segregation at the oxide-silicon interface upon annealing. Using the reaction $^{10}\text{B}(n, \alpha)^7\text{Li}$, and a grazing exit geometry, the depth resolution of the alpha-particle spectrum in NDP is approx. 10 nm. Better depth resolution is obtained in the calibrated SIMS profiles. For a wafer implanted with 70 keV $^{10}\text{B}^+$ through 194 nm SiO_2 to a dose of 1 times 10 to the 16th power pwr cm. sq., the segregation coefficient after annealing at 1000 deg C for a 30 minutes was approx. 3 from NDP. The segregated B was resolved better by SIMS and a segregation coefficient of 10 was indicated from the SIMS depth profile. Analysis of the B profile at the Si surface after chemically stripping the SiO_2 indicated a value equal to or less than 50.

800,240
PB88-192430 PC A05/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
Proceedings of the Symposium on Gaseous and Vapor Removal Equipment Test Methods Held at the National Bureau of Standards on September 2, 1986,
P. E. McNall. Feb 88, 92p NBSIR-88/3716

Keywords: *Ventilation, *Filtered particle testing, *Meetings, Gases, Vapors, Absorption, Adsorption, Air cleaners, Catalysis, Chemisorption, Reprints, Indoor air pollution.

The symposium proceedings summarize the current state-of-the-art on gaseous and vapor removal test methods for equipment designed for use in the general ventilation of buildings. Papers by the ten (10) invited authors are included. A discussion section outlines the conclusions reached concerning the future direction of test method development.

800,241
PB89-126783 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Failure Analysis of an Amine-Absorber Pressure Vessel.
Final rept.,
H. I. McHenry, D. T. Read, and T. R. Shives. 1987, 7p
Pub. in Materials Performance 26, n8 p18-24 Aug 87.

Keywords: *Crack propagation, *Gas scrubbing, *Weldments, *Hydrogen embrittlement, *Steels, Cracking(Fracturing), Pressure vessels, Amines, Corrosion mechanisms, Microstructure, Hydrogen sulfide, Absorption, Stress corrosion, Bursting, Reprints.

In 1984, a pressure vessel ruptured at a petroleum refinery and caused an explosion and fire. It fractured along a path that was weakened by extensive cracking adjacent to a repair weld joining a replacement section to the vessel. These pre-existing cracks initiated in areas of a hard microstructure as a result of hydrogen stress cracking. The cracks grew through the vessel wall as a result of hydrogen-induced stepwise cracking. When the depth of the largest of these cracks exceeded 90% of the wall thickness, the remaining ligament ruptured, resulting in a through crack 800 mm long. This crack triggered final fracture at the operating stress level of 35 MPa because the toughness of the vessel steel was reduced nearly threefold by hydrogen embrittlement.

800,242
PB89-126809 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Observations of Hydrogen Damage in a Failed Pressure Vessel.
Final rept.,
H. I. McHenry, P. T. Purtscher, and T. R. Shives. 1987, 17p
Pub. in Corrosion Science 27, n10-11 p1041-1057 1987.

Keywords: *Crack propagation, *Gas scrubbing, *Weldments, *Hydrogen embrittlement, *Steels, Cracking(Fracturing), Pressure vessels, Amines, Propane, Corrosion mechanisms, Hydrogen sulfide, Absorption, Stress corrosion, Bursting, Reprints.

An amine absorber tower, used to strip H_2S from propane, fractured adjacent to a repair weld made to replace a section of the vessel damaged by hydrogen blisters and delaminations. Hydrogen stress cracks developed during operation of the vessel at the inside surface (in martensite formed during repair welding). These cracks propagated by hydrogen pressure cracking in a zigzag path through the vessel wall. Catastrophic rupture initiated at an 800 mm long crack at a low stress level because hydrogen embrittlement reduced the fracture toughness of the steel by more than half. Observations of five types of hydrogen damage are discussed.

800,243
PB89-132831 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Gas Flowrate Metrology.
Final rept.,
G. E. Mattingly. 1988, 19p
Pub. in Proceedings of National Conference of Standards Laboratories, Washington, DC., August 14-18, 1988, p1-19.

Keywords: *Gas flow, *Flow rate, *Meetings, Performance evaluation, Fluid flow, Flowmeters, Calibrating, Metrology, Reprints, Fluid meters.

Increased concerns for improved gas flowrate measurements exist today in our nation's marketplaces, in our continuous process industries, and in the technologies which impact public safety and our national defense. To respond to these concerns, improvements are being sought in fluid measurements in existing installations and in fluid meters which are being retrofitted into flow systems where none previously existed. For all of these reasons, the NBS-Gaithersburg calibration facilities for gas flow should be known, accessible, and adequate to expressed needs. The NBS-Gaithersburg calibration techniques, facilities, ranges and levels of performance are briefly described for gas flowrate.

Photo & Radiation Chemistry

800,244
PATENT-4 772 745 Not available NTIS
Department of Commerce, Washington, DC.

Polymer-Reactive Photosensitive Anthracenes.
Patent,
Q. Tran-Cong, and C. C. Han. Filed 18 Aug 86, patented 20 Sep 88, 5p PB89-114557, PAT-APPL-6-897 227
Supersedes PB87-154696.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

Keywords: *Patents, *Photosensitivity, *Information processing, *Anthracene compounds, *Polymers, Carboxylic acids, Ultraviolet radiation, Chemical reactions, Ethers, Chlorine organic compounds, Aromatic alcohols, Aldehydes, Isocyanates, *Optical data storage materials.

Photosensitive anthracene compounds containing two anthracene rings joined by a flexible linkage, and containing a functional group as an annular substituent on one of the anthracene rings, react with polymers to form materials useful in information processings.

800,245
PB88-177571 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Cellulose Diacetate Film Dosimeters.
Final rept.,
W. L. McLaughlin, W. Z. Ba, and W. J. Chappas. 1988, 10p
Pub. in Radiation Physics and Chemistry 31, n4-6 p481-490 1988.

Keywords: Dosimetry, Gamma radiation, Reprints, *Blue cellophane, *Cellulose diacetate, Cellulose triacetate, Electron beams film dosimetry.

The radiation response characteristics of commercially available cellulose diacetate and cellulose triacetate films tinted with various colors are investigated, as well as the effects of dose rate, humidity, temperature, and pre- and post-irradiation stability. By using more than one color of film, a wide range of absorbed doses may be measured ($10(4) - 2 \times 10(4)$ Gy) with negligible dose-rate dependence. The films are reproducible and stable on extended storage before and after irradiation. Their responses, however, are dependent on temperature and relative humidity during irradiation. The wide availability and low price make these dosimeters candidates both for high-dose electron and photon applications and as routine monitors and dose-mapping systems for radiation curing and processing of materials.

800,246
PB88-181839 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Radiation Measurements of Large CH_4 Jet Diffusion Flames and the Effect of Water Sprays.
Final rept.,
B. J. McCaffrey. 1985, 4p
Pub. in Proceedings of Chemical and Physical Processes in Combustion, 1985 Fall Technical Meeting, Philadelphia, PA., November 4-6, 1985, Chemical and Physical Processes in Combustion 1985, p71.1-71.4.

Keywords: *Radiation, *Water sprays, *Flames.

No abstract available.

800,247
PB88-190145 Not available NTIS
National Bureau of Standards (NML), Washington, DC. Molecular Spectroscopy Div.
Microwave Spectrum and (^{14}N) Quadrupole Coupling Constants of Indole.
Final rept.,
R. D. Suenram, F. J. Lovas, and G. T. Fraser. 1988, 9p
Pub. in Jnl. of Molecular Spectroscopy 127, p472-480 1988.

Keywords: Reprints, Indole, Microwave spectrum, *Nitrogen quadrupole coupling constants, Structure, Molecular beam, *Microwave spectroscopy.

The microwave spectrum of indole has been observed using a conventional Stark-modulated microwave spectrometer in conjunction with a heated absorption cell. Spectral transitions were also observed in a pulsed molecular beam Fabry-Perot microwave spectrometer using a heated nozzle source. The high resolution (20 kHz) available with the Fabry-Perot instru-

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ment allows the observation of the (14)N nuclear electric quadrupole hyperfine analysis are $eQqAA = 1.7263(43)$ MHz; $eQqBB = 1.6525(50)$ MHz; and $eQqCC = -3.3788(48)$ MHz. The observed rotational constants are compared with those obtained from a recent optical study of indole and the (14)N quadrupole coupling constants are compared with those of pyrrole.

800,248

PB88-192216 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Ionizing Radiation Physics Div.
Electrical Aspects of the Snowflake Crystal.
Final rept.,
R. A. Schrack. 1985, 1p
Pub. in *Nature* 314, n6009 p324 1985.

Keywords: Reprints, Dendrites, *Electrical fields,
*Snowflakes, Symmetry.

Letter to the editor of *Nature* magazine calling attention to previous work which indicated the electrostatic origin of snowflake symmetry.

800,249

PB88-192224 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Ionizing Radiation Physics Div.
Analysis of the Effect of Random Events on the 14 MeV U-235(n,f) Cross Section Measurement.
Final rept.,
O. A. Wasson, A. D. Carlson, and K. C. Duvall. 1986, 4p
Pub. in *Radiation Effects* 96, n1-4, p9-12 1986.

Keywords: Timing, Reprints, Coincidence, *Cross section, Neutron, *Random events.

Analysis of the authors measurement of the $^{235}\text{U}(n,f)$ cross section standard at 14 MeV demonstrates that no change in the published results due to random coincidence events is required.

800,250

PB88-230297 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.
T-V Energy Transfer and Chemical Reactions of Laser-Produced Hot H and D Atoms.
Final rept.,
L. M. Cousins, and S. R. Leone. 1988, 3p
Grants NSF-PHY86-04504, NSF-CHE84-08403
Sponsored by National Science Foundation, Washington, DC.
Pub. in *Radiochimica Acta* 43, p107-109 1988.

Keywords: *Photolysis, *Hydrogen, *Deuterium, Kinetic energy, Particle interaction, Vibration, Excitation, Energy transfer, Hydrogen iodide, Hydrogen bromide, Hydrogen chloride, Hydrogen sulfide, Reprints, *Hot atom chemistry, Excimer lasers, Collisions.

Laser photolysis of various molecular precursors provides a means to generate translationally fast H and D atoms with laboratory energies in the range of 1-3 eV. With typical precursors such as HI, HBr, HCl, and H₂S, and excimer laser wavelengths at 193 and 248 nm, the widths of the H atom kinetic energy distributions are small compared to the total energies, providing a rather precise collision energy. Kinetic energies in the range of 1-3 eV are sufficient to overcome many barriers to chemical reaction or to populate vibrational states up to $v=5$ or 10 by translation-to-vibration (T-V) excitation processes. Thus, a flourishing field has been born and is being used in many laboratories to study the fundamental dynamics of reactive and energy transfer collisions of these translationally hot H and D atoms with numerous collision partners. The states of the products of the collision events in the authors work are probed by both sensitive infrared fluorescence as well as laser-induced fluorescence. These techniques yield state-resolved vibrational and rotational information for the dynamics of the hot atom collision.

800,251

PB88-230438 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Inorganic Analytical Research Div.
Measurement of Low Abundance Isotopes by Laser Resonance Ionization Mass Spectrometry (RIMS).
Final rept.,
J. D. Fasset, R. J. Walker, J. C. Travis, and F. C. Ruegg. 1988, 18p
Pub. in *Analytical Instrumentation* 17, n1-2 p69-86 1988.

Keywords: *Iodine isotopes, *Radioactive analysis, Reprints, *Resonance ionization mass spectrometry, Laser applications, Iodine 129.

The application of laser resonance ionization mass spectrometry (RIMS) to the measurement of low abundance isotopes was investigated. The long-lived radionuclide (¹²⁹I) was used to evaluate the present capabilities. Issues of sensitivity and selectivity were studied, as well as dynamic range limitations imposed by the low-duty-cycle pulsed ionization process.

800,252

PB89-101695 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Organic Analytical Research Div.
Photodissociation of Chlorostyrene Molecular Ions.
Final rept.,
G. J. Collins, K. Kiss, D. J. Pereles, and E. White. 1986, 2p
Sponsored by Stauffer Chemical Co., Dobbs Ferry, NY.
Pub. in *Organic Mass Spectrometry* 21, p447-448 1986.

Keywords: *Photochemical reactions, *Dissociation, Stereochemistry, Chlorine organic compounds, Mass spectroscopy, Ions, Reprints, *Styrene/chloro, Laser induced fragmentation, Isomers.

Photodissociation of molecular ions of m-, o-, and p-chlorostyrene was studied in the first field free region of a double focusing mass spectrometer. Ions were formed in a conventional electron impact ion source and passed through a laser beam which was focused so as to be co-linear with the ion beam over the length of the first field free region. Laser induced fragmentation was monitored by phase sensitive detection of the chopped laser on/laser off signals arriving at the detector. Isomer specific differences in the photofragmentation of the three isomers were observed. The effects of varying source pressure, laser intensity and laser wavelength were studied.

800,253

PB89-119200 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Radiation Physics Div.
Experimental and Theoretical Determinations of the 5d Photoionization Cross Section in Laser-Excited Barium Atoms between 15 and 150 eV Photon Energy.
Final rept.,
J. M. Bizau, D. Cubaynes, P. Gerard, F. J. Wuilleumier, J. C. Keller, J. L. LeGouet, J. L. Picque, D. L. Ederer, B. Carre, and G. Wendin. 1986, 4p
Pub. in *Physical Review Letters* 57, n3 p306-309, 21 Jul 86.

Keywords: *Barium, *Ionization, *Photochemical reactions, *Cross sections, Experimental design, Numerical analyses, Electronic spectra, Excitation, Reprints, *Laser excited ionization.

The authors report the measured and calculated photoionization cross section of the excited 5d electron in neutral barium. Local density based random phase approximation calculations (LDRAP) and experiments show resonance enhancement of the 5d cross section when the 4d ionization channel opens up. There is good agreement between the theory and experiment over a broad energy range.

800,254

PB89-127161 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Ionizing Radiation Physics Div.
Standardization of Isomeric-Transition Radionuclides by Liquid-Scintillation Efficiency Tracing with Hydrogen. 3. Application to Technetium-99m.
Final rept.,
A. G. Malonda, and B. M. Coursey. 1987, 6p
Pub. in *Applied Radiation and Isotopes* 38, n9 p695-700 1987.

Keywords: *Technetium isotopes, *Isotopic labeling, Monte Carlo method, Radioactive isotopes, Reprints, *Technetium 99, *Liquid scintillators.

The isomeric-transition radionuclide (sup 99m)Tc has been standardized by the method of liquid-scintillation efficiency-tracing with (sup 3)H. The two-phototube coincidence-counting efficiency is computed as 0.28, with an uncertainty (one standard deviation) of + or - 3.4%. The agreement between calculated and experi-

mental efficiencies is better for spectral regions corresponding to Compton electrons and conversion electrons.

800,255

PB89-132922 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.
Application of Semiconductor Diode Lasers to Probe Photodissociation Dynamics.
Final rept.,
H. K. Haugen, W. P. Hess, and S. R. Leone. 1987, 3p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in *Proceedings of International Laser Science Conference, Advances in Laser Science II*, Seattle, WA., October 1986, p566-568 1987.

Keywords: *Iodine, Electron transitions, Atomic energy levels, Quantum efficiency, Haloalkanes, Photolysis, Semiconductor lasers, *Photodissociation, Alkyl compounds, Laser spectroscopy.

Tunable diode lasers are rapidly proving to be useful probes of atomic and molecular species. In the present study the authors use a semiconductor diode laser to probe the photodissociation dynamics of alkyl iodides. A room temperature InGaAsP diode laser operating at 1315 nm is used to probe the transition between I*(doublet P(1/2)) and I(doublet P(3/2)) atoms. I* quantum yields are obtained in the UV laser photolysis of n- and i-C₃F₇I, CH₃I and ICN by time resolved laser gain versus absorption spectroscopy. The high amplitude stability of the diode laser and the internal normalization of the gain versus absorption technique allow for a sensitive and accurate determination of the I* quantum yields.

Physical & Theoretical Chemistry

800,256

NUREG/CR-5166 PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg,
MD. Center for Chemical Engineering.
Electrochemical Evaluation of Solid State pH Sensors for Nuclear Waste Containment.
P. H. Huang, and K. G. Kreider. May 88, 30p NBSIR-88/3790
Also available from Supt. of Docs. Sponsored by Nuclear Regulatory Commission, Washington, DC. Office of Nuclear Regulatory Research.

Keywords: *pH meters, *Radioactive waste facility, Radioactive wastes, *Iridium oxides, *Voltammetry, Electrodes, Underground storage, Extrusive rocks, Theories, Electrochemistry, High pressure, High temperature, Tuff.

The report contains a literature review for electrochemical evaluation of solid state pH sensors. The requirements of pH electrode for geochemical fluids in a nuclear waste repository site are rather difficult to fulfill, that is, the electrode must have stability at temperatures up to 250 deg C, low ionic and redox interferences, corrosion resistance, and robustness. Among the potential electrode materials, the IrO₂ emerges as the most promising because of its consistent near Nernstian response, and its electrochemical behavior at the IrO₂-solution interface is essential in order to optimize the performance of IrO₂ electrodes for pH sensing at high temperatures and pressures. The report reviews theoretical models of the oxide-solution interfaces based on the theory of the electric double layer. Electrochemistry of IrO₂ films with emphasis on the properties of anodic films is summarized. A plan for pH testing of sputtered iridium oxide films (SIROF) for geochemical measurements at a Tuff Repository is described.

800,257

PB88-164173 PC A03/MF A01
National Bureau of Standards (ICST), Gaithersburg,
MD. Information Systems Engineering Div.

Physical & Theoretical Chemistry

Prototype Expert System: An Automated Advisor to Select Data Sources from Chemical Information Databases.
E. N. Fong, and C. E. Dabrowski. Jan 88, 48p
NBSIR-88/3689

Keywords: *Chemistry, *Information systems, *Vapor pressure, Prototypes, Automation, Decision making, Data, Sources, *Expert systems, *Man computer interface, *Knowledge based systems, Data bases.

A prototype expert system, called 'Automated Advisor', was built as a part of a competency project within the Institute for Computer Sciences and Technology. The system conducts dialogue with the end-users and recommends a list of data sources from chemical information databases. The report describes the problem domain and documents the knowledge engineering process.

800,258
PB88-169453 PC A03/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Technical Activities 1987, Surface Science Division.
C. J. Powell. Jan 88, 28p NBSIR-88/3699
See also PB86-166733.

Keywords: *Surface chemistry, Standards, Catalysis, Electron spectra, Atomic structure, Adsorption.

The report gives a brief summary of the technical activities conducted in the NBS Surface Science Division during Fiscal Year 1987. These activities include surface-standards work, experimental and theoretical research in surface science, the development of improved measurement methods, and applications to important scientific and national problems. Listings are given of publications, talks, Division staff, and guest scientists.

800,259
PB88-169867 PC A03/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Thermodynamic Properties of the Alkaline Earth Metal Hydroxides (MOH). 1. Literature Citations.
Technical note (Final),
M. W. Chase. Dec 87, 46p NBS/TN-1243
Also available from Supt. of Docs. as SN003-003-02847-9.

Keywords: *Bibliographies, Equilibrium data, Formation properties, Ionization potential, Molecular structure, *Alkaline earth hydroxides, *Electron affinity, Electronic energy levels.

A bibliographic collection is provided on data which are necessary for the calculation of the thermochemical properties of the gaseous alkaline earth metal (mono)hydroxides (MOH) and their positive ions (MOH⁺), where M = Be, Mg, Ca, Sr, and Ba. This is the first in a series of articles that will document the information used in the critical evaluation of the thermodynamic properties for the JANAF Thermochemical Tables. The collection contains references which have been published through the end of 1985, with a limited number of 1986 references. Five bibliographies are given, one for each of the alkaline earth metals. In each bibliography, the references are listed chronologically; alphabetically by first author within each year. The names of the ten species are given according to the Chemical Abstracts system of nomenclature (as of the Tenth Collective Index). The Chemical Abstracts Registry Numbers are also given for each of the species. A brief summary of the type of available information is given.

800,260
PB88-173927 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Chemisorption and Dissociation of O₂ on Cr(110): An EELS/ESDIAD (Electron Energy Loss Spectroscopy/Electron Stimulated Desorption Ion Angular Distributions) Study.
Final rept.,
N. D. Shinn, and T. E. Madey. 1986, 4p
Pub. in Nuclear Instruments and Methods in Physics Research B13, n1-3 p537-540, 1 Mar 86.

Keywords: *Chemisorption, *Oxygen, Chemical bonds, Atomic spectra, Spectroscopy, Reprints, *Chromium 110, Auger spectroscopy, Desorption, Ion distribution, Binding energy.

Electron stimulated desorption ion angular distributions (ESDIAD) and high resolution electron energy loss spectroscopy (EELS) have been used in conjunction with Auger electron spectroscopy (AES) and low energy electron diffraction (LEED) to identify molecular and atomic binding states for oxygen chemisorbed on Cr(110).

800,261
PB88-174024 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Pulse Radiolysis of Hexafluorobenzene: Production and Quenching of C₆F₆(1⁺).
Final rept.,
F. P. Schwarz, H. Okabe, and P. Ausloos. 1985, 5p
Pub. in Chemical Physics Letters 119, n2-3 p188-192, 30 Aug 85.

Keywords: Production, Radiolysis, Excitation, Fluorescence, Reprints, *Benzene/hexafluoro, *Charge exchange, Quenching.

Emission from the first electronic excited state of C₆F₆(1⁺) (B) was observed in the pulse radiolysis of C₆F₆(1⁺) (B) through charge transfer from CO₂, Kr⁺, Ar⁺, and Ne were determined from measurements of the time-resolved fluorescence from C₆F₆(1⁺) (B). The values agree with values for these rate constants determined in an ion cyclotron resonance spectrometer.

800,262
PB88-174040 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
One- and Two-Electron Reduction of Metalloporphyrins. Radiation Chemical, Photochemical, and Electrochemical Studies. Kinetics of the Decay of pi-Radical Anions.
Final rept.,
M. C. Richoux, P. Neta, A. Harriman, S. Baral, and P. Hambright. 1986, 7p
Pub. in Jnl. of Physics and Chemistry 90, n11 p2462-2468 1986.

Keywords: *Porphyrins, *Electrochemistry, Radiolysis, Decay, Metal containing organic compounds, Methanol, Solutions, Reprints, *Metalloporphyrins, *Photolysis, Aqueous solutions.

One- and two-electron reduction products of several metalloporphyrins have been studied by steady-state and pulse radiolysis in aqueous solutions. The study concentrates on the TMPyP (tetra(N-methyl-4-pyridyl)porphyrin) complexes of (3)Ga, (4)Ge, and (3)In, and the TPyP (tetra(3-pyridyl)porphyrin) complex of (5)Sb, and compares them with the previously studied complex of (2)Zn, (3)Al, (4) and Sn.

800,263
PB88-174057 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
One- and Two-Electron Oxidation of Lead (II) Tetrakis(N-Methylpyridyl) Porphyrins in Aqueous Solution.
Final rept.,
P. Neta, M. C. Richoux, and A. Harriman. 1986, 7p
Pub. in Jnl. of the Chemical Society, Faraday Transactions 2, v82 n2 p201-207 1986.

Keywords: *Porphyrins, Oxidation, Radiolysis, Lead, pH, Reprints, *Metalloporphyrins, *Absorption spectroscopy, Aqueous solutions.

In aqueous solution at pH 9, lead (II) tetrakis(N-methylpyridyl) porphyrins are oxidized rapidly to the metalloporphyrin pi-radical cations by Br₂ under pulse radiolytic conditions. The pi-radical cations disproportionate at a rate close to the diffusion controlled limit. The doubly-oxidized metalloporphyrin so formed can be assigned to the lead (IV) porphyrin, on the basis of absorption spectroscopy. These highly oxidized metalloporphyrins decay via first order kinetics (k = 0.93 + 0.05/s at pH9. Even in the presence of colloidal RuO₂ 2H₂O, the decay process does not oxidize water to O₂.

800,264
PB88-174073 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Intramolecular Association of Covalently-Linked Viologen Radicals.

Final rept.,
P. Neta, M. C. Richoux, and A. Harriman. 1985, 17p
Pub. in Jnl. of Chemical Society, Faraday Transactions 2, v81 n9 p1427-1443 1985.

Keywords: Chemical bonds, Reprints, *Viologen radicals, *Intermolecular structures, Dimers.

A series of compounds was synthesized having two identical viologen groups separated by organic bridges of varying degree of flexibility. Chemical or radiolytic reduction results in formation of the viologen - radical cations which undergo disproportionation to form the doubly reduced viologen. In the species, both viologen units are reduced and there is a distinct stabilization effect if the molecule can form an intramolecular cofacial dimer. The disproportionation constants have been determined by cyclic voltammetry and depend markedly upon the type of bridging group employed. Using pulse radiolysis, it was shown that the mono radical could be stabilized by intramolecular associate with the unreduced viologen.

800,265
PB88-174081 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Hydrogen Transfer between Anthracene Structures.
Final rept.,
R. Billmers, L. L. Griffith, and S. E. Stein. 1986, 7p
Pub. in Jnl. of Physical Chemistry 90, n3 p517-523 1986.

Keywords: Anthracene compounds, *Aromatic polycyclic hydrocarbons, Reaction kinetics, Reprints, *Hydrogen transfer.

The work reports results of kinetic studies of hydrogen migration between 9,10-dihydro-positions in anthracene structures.

800,266
PB88-174115 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Ethylbenzene Pyrolysis: Benzyl C-C or C-H Bond Homolysis.
Final rept.,
D. A. Robaugh, W. Tsang, A. Fahr, and S. E. Stein. 1986, 8p
Pub. in Berichte der Bunsen Gesellschaft fuer Physikalische Chemie 90, n1 p77-84 1986.

Keywords: *Ethyl benzene, Thermal decomposition, Pyrolysis, Chemical bonds, Shock tubes, Reprints, *Isopropyl benzene, Low pressure, Homolysis.

The thermal unimolecular decomposition of ethylbenzene has been studied by both the very-low-pressure pyrolysis and heated single-pulse shock tube methods in an attempt to resolve a recent controversy as to whether the initial dissociation channel is benzyl C-C, PhCH₂CH₃ => PhCH₂ + CH₃ or benzyl C-H homolysis, PhCH₂CH₃ => PhCHCH₃ + H. Observed decomposition products and mass balance studies led to the conclusion that up to 1288K the predominant decomposition channel is benzyl C-C homolysis. Additional support of the conclusion was provided by a study of isopropylbenzene decomposition by these same methods. Arguments were given which strongly suggest that benzyl C-H homolysis cannot be the major reaction channel even at temperatures as high as 1600K.

800,267
PB88-174123 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Ionic Hydrogen Bond and Ion Solvation. 4. (SH(1+))..O and (NH(1+))..S Bonds. Correlations with Proton Affinity. Mutual Effects of Weak and Strong Ligands in Mixed Clusters.
Final rept.,
M. Mautner, and L. W. Sieck. 1985, 4p
See also PB85-230415.
Pub. in Jnl. of Physics and Chemistry 89, n24 p5222-5225, 21 Nov 85.

Keywords: *Hydrogen bonds, Thermochemistry, Chemical bonds, Mass spectroscopy, Ligands, Reprints, *Sulfur compounds, Ion pairs.

CHEMISTRY

Physical & Theoretical Chemistry

Ionic hydrogen bonds of the type $\text{SH}(1+)...0$, i.e., dissociation energies of the complexes $\text{R}_2\text{SH}(1+)...0\text{H}_2$, range from 12 to 19 kcal/mol, and exhibit an inverse linear relationship with the proton affinity difference $\Delta\text{PA} = \text{PA}(\text{R}_2\text{S}) - \text{PA}(\text{H}_2\text{O})$, of the form dissociation energy = $-17.7 - 0.13 \Delta\text{PA}$ kcal/mol. Ionic hydrogen bonds of the type $\text{NH}(1+)...S$ are also relatively weak, with values between 11 and 15 kcal/mol. However, some symmetric dimers of the type $\text{SH}(1+)...S$, e.g. $(\text{CH}_3)_2\text{SH}(1+)...S(\text{CH}_3)_2$ are more strongly bonded, with dissociation energy = 26 kcal/mol. Using the weakly bonding sulfur ligand CH_3SH and a strongly bonding polar ligand, CH_3CN , in a mixed cluster $\text{CH}_3\text{NH}_3(1+)...(\text{CH}_3\text{SH})_2\text{CH}_3\text{CN}$, it is observed that the bond weakening effect of the weak ligand on the interaction of the core ion with the strong ligand is only 13%, while in the opposite combination, i.e., the effect of the strong ligand, CH_3CN , on the interaction of the core ion with either a second weak ligand (CH_3SH) or a second strong ligand (CH_3CN) is to cause weakening of the bonds by 26 and 29%, respectively.

800,268

PB88-174131

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Ionic Hydrogen Bond and Ion Solvation. 3. Bonds Involving Cyanides. Correlations with Proton Affinities.

Final rept.,

C. V. Speller, and M. Mautner. 1985, 6p

See also PB85-230407.

Pub. in Jnl. of Physics and Chemistry 89, n24 p5217-5222 1985.

Keywords: *Cyanides, *Mass spectroscopy, Chemical bonds, Reaction kinetics, Protons, Reprints, *Hydrogen bonds, Affinity, Ion spectroscopy.

The dissociation energies of complexes $\text{RCNH}(1+) \text{B}$ or $\text{BH}(1+) \text{NCR}$ show inverse linear correlations with the proton affinity difference (ΔPA) of the components. Complexes of protonated amines with cyanide ligands are stronger by about 10 kcal/mol than analogous complexes with amine ligands, due to the large dipole moments of the cyanides. The corresponding correlation lines are (kcal/mol) = $35.3 - 0.34 \Delta\text{PA}$ for $\text{R}_3\text{NH}(1+) \text{NCR}$ and $23.2 - 0.25 \Delta\text{PA}$ for $\text{R}_3\text{NH}(1+) \text{NRE}$ complexes. Complexes of cyanides with $\text{NH}_4(1+)$ are more weakly bonded by 4 + or - 1 kcal/mol than complexes with alkylammonium ions. Other correlation parameters are given.

800,269

PB88-174743

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.

Experimental Studies of the Correlations between Gas Sensor Response and Surface Chemistry.

Final rept.,

S. Semancik, and D. F. Cox. 1986, 2p

Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surfaces and Films 4, n3 p626-627 1986.

Keywords: *Gases, *Detectors, *Surface chemistry, Materials, Sensitivity, Chemical analysis, Experimentation, Photoelectric emission, Conductivity, Reprints.

Experimental methods are described for characterizing the surface chemical behavior and electronic response produced by the interaction of gases with sensing materials. Data obtained from these methods can be used to model the sensing mechanisms by which chemical sensors operate.

800,270

PB88-174784

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Inversion of Second Virial Coefficients for Polyatomic Molecules.

Final rept.,

J. P. M. Trusler. 1986, 7p

Pub. in Molecular Physics 57, n5 p1075-1081 1986.

Keywords: Gases, *Polyatomic molecules, Thermophysical properties, Virial equations, Reprints, *Dilute gases, Inversions.

Inversion of the second virial coefficient $B(T)$ of a polyatomic gas yields an effective isotropic pair-potential-energy function $U(\text{sub inv})(r)$; the relation between this and the true anisotropic function is investigated.

800,271

PB88-174842

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Thermodynamic and Kinetic-Properties of the Cyclohexadienyl Radical.

Final rept.,

W. Tsang. 1986, 4p

Pub. in Jnl. of Physical Chemistry 90, n6 p1152-1155 1986.

Keywords: Decomposition, Entropy, Thermodynamic properties, Heat of formation, Kinetics, Reprints, *Cyclohexadienyl radical.

The experimental data on cyclohexadienyl (1,4-cyclohexadienyl-6) radical decomposition have been examined. In combination with an estimated entropy for cyclohexadienyl of 375 + or - 7 J/K-mol at 550 K, and the measured rates of hydrogen addition to benzene the authors find $k(\text{cyclohexadienyl} \rightarrow \text{benzene} + \text{H}) = 10$ to the 13.25th power + or - $0.4 \exp(-13090 + \text{or} - 500/T)$ /sec in the vicinity of 550 K. This is consistent with a heat of formation of cyclohexadienyl of 209 + or - 5 kJ/mol (300 K). The C-H bond energy in cyclohexadienyl is 318 kJ, leading to a resonance energy of 96 kJ. The second order disappearance rate of cyclohexadienyl radical at 425 K has been found to be 700 billion cc/molecule-sec. This is in excellent agreement with direct measurements at room temperature.

800,272

PB88-174859

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Thermochemistry of Solvation of Nitrate Anion ($\text{NO}_2(1-)$) and Nitrobenzene Anion ($\text{C}_6\text{H}_5\text{NO}_2(1-)$) by Polar Molecules in the Vapor Phase. Comparison with Chloride ($\text{Cl}(1-)$) and Variation with Ligand Structure.

Final rept.,

L. W. Sieck. 1985, 5p

Pub. in Jnl. of Physics and Chemistry 89, n25 p5552-5556 1985.

Keywords: *Solvation, *Thermochemistry, Mass spectrometry, Ligands, Reprints, Nitrate ions, Nitrobenzene ions, Vapor phase.

The stabilities of $\text{NO}_2(1-)\text{HR}$ and $(\text{C}_6\text{H}_5\text{NO}_2(1-))\text{HR}$ association ions, where HR is a dipolar protic or aprotic organic molecule, have been investigated by the technique of pulsed electron beam high-pressure mass spectrometry. For comparison, analogous measurements were also made with $\text{Cl}(1-)$. Equilibrium constants were determined. Probable structures for $(\text{C}_6\text{H}_5\text{NO}_2(1-))\text{HR}$ ions are presented and discussed.

800,273

PB88-174867

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Temperature Effects on Rates of Dehalogenation of Aromatic Anion Radicals.

Final rept.,

M. Mautner, P. Neta, R. K. Norris, and K. Wilson.

1986, 6p

Pub. in Jnl. of Physical Chemistry 90, n1 p168-173 1986.

Keywords: Anions, Radicals, Radiolysis, Energy transfer, Reprints, *Temperature dependence, *Charge exchange, Haloacetophenones, Dehalogenation, Nitrobenzyl halides, Chloro radicals, Bromo radicals, Nitro radicals.

The temperature dependence of the unimolecular dehalogenation of radical anions of nitrobenzyl halides and haloacetophenones was measured between -7 and 70 C.

800,274

PB88-174875

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Single Pulse Shock Tube Study on the Stability of Perfluorobromomethane.

Final rept.,

W. Tsang. 1986, 5p

Pub. in Jnl. of Physical Chemistry 90, n3 p414-418 1986.

Keywords: *Decomposition, Cyclopentane, Ethylene, Shock tubes, Heat of formation, Energy transfer, Reprints, *Methane/perfluoro-bromo.

Perfluorobromomethane has been decomposed in comparative rate single pulse shock tube experiments.

Reaction extent was determined by measuring the ethylene yields from the induced decomposition of cyclopentane.

800,275

PB88-174883

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Stabilities of Highly-Conjugated Radicals from Bond Homolysis Rates.

Final rept.,

D. A. Robaugh, and S. E. Stein. 1986, 6p

Pub. in Jnl. of the American Chemical Society 108, n12 p3224-3229 1986.

Keywords: *Pyrolysis, *Chemical bonds, Radicals, Stabilities, Chemical determination, Measuring instruments, Reprints, *Benzyl radicals, *Rate constants, Low pressure, Homolysis.

Rates of benzyl C-CH₃ homolysis of 4-ethylstyrene(2), 1-phenyl-1-butene(3), 1,1'-diphenylethane (4), 2,2'-diphenylpropane(5), and 1-methyl-indene(6) were measured in a very-low-pressure-pyrolysis apparatus. Observed rate constants were fit by high-pressure Arrhenius expressions using RRKM theory.

800,276

PB88-174891

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Resonance Stabilization of Zinc Porphyrin pi-Radical Cations.

Final rept.,

P. Neta, M. C. Richoux, A. Harriman, and L. R.

Milgrom. 1986, 9p

Pub. in the Jnl. of the Chemical Society, Faraday Transactions 2, v82 n2 p209-217 1986.

Keywords: *Radiolysis, Cations, Oxidation, Atomic energy levels, Electrode potentials, Reprints, *Zinc porphyrins, Radicals, Pulse radiolysis.

Pulse radiolytic oxidation of zinc tetrakis (hydroxyphenyl) porphyrins in neutral solution results in formation of the pi-radical cations which decay via disproportionation over a few ms. In alkaline solution, the hydroxyl groups are dissociated and for the ortho and meta isomers the rate of disproportionation is somewhat reduced relative to neutral solution due to Coulombic repulsion between the ions. In contrast, the para isomer shows a very long-lived pi-radical cation ($t(\text{sub } 1/2)\text{Ca. } 5\text{s}$) in alkaline solution. This arises from resonance stabilization associated with the ability of the substituent to push charge onto the porphyrin ring. The ortho isomer does not exhibit the effect due to steric hindrance.

800,277

PB88-174909

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Rates and Mechanisms of Reduction of Trisphenanthroline-Fe(III) by Various Radicals. Effects of Solvent.

Final rept.,

P. Neta, J. Grodkowski, C. J. Schlesener, and J. K.

Kochi. 1985, 6p

Pub. in Jnl. of Physics and Chemistry 89, n20 p73-78 1985.

Keywords: *Electron transitions, Energy transfer, Radiolysis, Radicals, Acetonitrile, Solutions, Reprints, *Alkyl radicals, *Iron/tris(phenanthroline), *Iron complexes, *Aqueous solutions.

(3)Fe (phenanthroline)₃, is reduced to (2)Fe-complex by a wide variety of radicals in aqueous solutions. Reduction by -hydroxyalkyl radicals takes place with nearly diffusion-controlled rate constants (3.5 billion / M / S) and involves an outer sphere electron transfer. Reduction by other substituted alkyl radicals, as well as methyl and ethyl, is less rapid to varying degrees (10^6 - 10^9 / M / S) and may involve an inner sphere mechanism, whereby the radical attaches to the iron center in an intermediate stage. Addition of alkyl radicals to a phenanthroline carbon, which occurs in acetonitrile solutions, becomes less likely in water, because it is slow relative to the other processes. In the case of the OH radical reaction, however, addition to carbon followed by an intramolecular electron transfer may be the only operative mechanism for reduction of (3)Fe (phen)₃.

800,278

PB88-174917 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Chemical Kinetics Div.

Radiation Induced Reactions of Polymer Radicals with Ruthenium Trisbipyridyl OH Adduct in Aqueous Solutions.

Final rept.,
P. Neta, J. Silverman, V. Markovic, and J. Rabani.
1986, 5p
Pub. in Jnl. of Physics and Chemistry 90, n4 p703-707
1986.

Keywords: *Polyelectrolytes, *Polyoxyethylene, Radiolysis, Gamma irradiation, Reprints, *Polymer radicals, *Polyethylene glycols, *Polybrene, *Ruthenium/tris(bipyridyl).

Polymer radicals are produced by H abstraction from polyethylene glycol (PEG) and polybrene (PB) and by H abstraction and OH addition to polystyrene sulfonate (PSS). When ruthenium trisbipyridyl ions ($\text{Ru}(\text{bpy})_2^{2+}$) are also present, they compete for OH and H radicals and produce the appropriate adducts. These adducts may disproportionate or react with the polymer radicals. The kinetic constants of these systems were measured by pulse radiolysis. The reaction products were also studied by dialysis of these systems following irradiation.

800,279

PB88-174933 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Chemical Kinetics Div.

Photooxidation of Water Using Prussian Blue as Catalyst.

Final rept.,
P. Neta, M. C. Richoux, P. Christensen, and A. Harriman. 1985, 6p
Pub. in Jnl. of the Chemical Society, Faraday Transactions 1, v81 n10 p2461-2466 1985.

Keywords: *Water, *Catalysts, *Electron transitions, Radiolysis, Decay, Lead, Reprints, *Oxygen production, *Prussian blue, *Ruthenium/tris(bipyridyl), *Photooxidation, Aqueous solutions.

Pulse radiolysis experiments have shown that Prussian Blue (PB) catalyzes decay of tris (2,2'-bipyridyl)ruthenium (III) in aqueous solution at pH 3.2. The bimolecular rate constant for electron transfer between PB and $\text{bipy}(3) \text{Ru} (3+)$ is $210000 \text{ cm}^3 \text{ dm}^3/\text{mol/s}$, which is well below the diffusion controlled limit. The reaction leads to oxidation of water of O_2 and irradiation of $\text{bipy} (3) \text{Ru} (2+)$ in aqueous solution containing sodium persulfate (as sacrificial electron acceptor) and PB generates O_2 with a quantum efficiency of ca.2%. The limiting yield of $\text{O}_2(0.0015 \text{ sq mol/cu dm})$ is set by the PB catalyzed reduction of O_2 and by O_2 quenching of triplet $\text{bipy}(3)\text{Ru}(2+)$.

800,280

PB88-175203 Not available NTIS
National Bureau of Standards (NML), Washington, DC.
Molecular Spectroscopy Div.

Infrared Tunable Diode Laser Spectroscopy of the Delta nu = 2 Band of (7)Li(127).

Final rept.,
G. Thompson, A. G. Maki, and A. Weber. 1986, 4p
Pub. in Jnl. of Molecular Spectroscopy 118, n2 p540-543 1986.

Keywords: Infrared spectra, Reprints, *Lithium iodides, Laser spectroscopy, Tunable lasers, Lithium 7, Iodine 127, High resolution, Dunham constants.

The high resolution infrared spectrum of the $\delta \nu = 2$ transition of (7) LiI has been measured at temperatures near 1050K. The observations include vibrational transitions ranging from 2-0 to 10-8. The data were fit to a set of Dunham potential constants complete through the $a(6)$ term, from which the Dunham rovibrational constants were calculated. The band centers for the $v = 1-0$ and $v = 2-0$ transitions were determined to be $491.17398 \pm 0.00026/\text{cm}$ and $976.73042 \pm 0.00038/\text{cm}$ respectively.

800,281

PB88-175245 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Molecular Spectroscopy Div.

Picosecond Laser Induced Fluorescence Study of the Collisionless Photodissociation of Nitrocompounds at 266 nm.

Final rept.,
J. C. Mialocq, and J. C. Stephenson. 1986, 11p
Pub. in Chemical Physics 106, n2 p281-291, 15 Jul 86.

Keywords: *Nitramines, *Photochemistry, Kinetics, Picosecond lasers, Reprints, Energetic materials, Laser induced fluorescence, Nitroalkanes.

The photodissociation of nitroalkanes and dimethylnitramine by picosecond laser pulses at 266 nm has been investigated by observing fluorescence from electronically excited $\text{NO}(2)$ formed directly in the UV photodissociation process and also by laser induced fluorescence (LIF) probing of NO_2 formed in the electronic ground state. The formation of the ground state fragment is a monophotonic process, and follows closely the integrated laser pulse shape, implying that the NO_2 is formed within 6 ps after absorption of a 266 nm photon by CH_3NO_2 or $(\text{CH}_3)_2\text{NNO}_2$. Formation of $\text{NO}(2)$ from dimethylnitramine was monophotonic; for the nitroalkanes the observed $\text{NO}(2)$ formation was much less efficient and increased faster than linearly with increasing energy in the UV photolysis pulse. In the R- $\text{NO}(2)$ nitroalkanes under study ($R = \text{CH}_3, \text{C}_2\text{H}_5, n\text{-C}_3\text{H}_7$ and $1\text{-C}_3\text{H}_7$), the quantum efficiency of NO_2 formation does not depend on the nature of the alkyl group. An estimation of the quantum yields of photodissociation is discussed.

800,282

PB88-175393 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Inorganic Analytical Research Div.

Resonant Laser-Induced Ionization of Atoms in an Inductively Coupled Plasma.

Final rept.,
G. C. Turk, and R. L. Watters. 1985, 5p
Pub. in Analytical Chemistry 57, n9 p1979-1983 1985.

Keywords: Ionization, Atomic energy levels, Reprints, Atom - atom collisions, Dye lasers, Laser spectroscopy, Laser radiation, Rydberg states, *Iron atoms, *Manganese atoms, *Sodium atoms, *Copper atoms.

The use of tunable dye laser radiation to selectively ionize atoms in an inductively coupled plasma (ICP) has been investigated. Laser induced ionization was measured as an increase in current between biased electrodes on either side of the ICP tail flame. Interaction between the radio-frequency plasma and the detection circuitry required that the electrodes be placed at least 19 cm above the load coil while using an extended ICP torch. Resonant laser induced ionization was detected for Fe, Mn, Na, and Cu.

800,283

PB88-175666 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Atomic and Plasma Radiation Div.

Effect of Electric Fields on Autoionizing Resonances.

Final rept.,
D. E. Kelleher, E. B. Saloman, and J. W. Cooper. 1985, 2p
Pub. in Proceedings of the International Conference on Laser Spectroscopy VII (7th), Maui, HI., June 24-28, 1985, p98-99.

Keywords: *Barium, Stark effect, *Autoionization, *Photoionization.

Recent work on field mixing of barium autoionizing resonances is described. Examples of destructive interference and of asymmetric line profiles are presented.

800,284

PB88-176532 Not available NTIS
National Bureau of Standards (NML), Washington, DC.
Molecular Spectroscopy Div.

Microwave Detection of the Primary Ozonide of Ethylene in the Gas Phase.

Final rept.,
J. Zozom, C. W. Gillies, R. D. Suenram, and F. J. Lovas. 1987, 7p
Pub. in Chemical Physics Letters 140, n1 p64-70, 18 Sep 87.

Keywords: Reprints, *Dipole moment, *Microwave spectrum, *Ozone chemistry, Ozone ethylene reaction, Photochemical smog, Primary ozonide.

The primary ozonide of ethylene ($\text{CH}_2\text{CH}_2\text{O}_3$) has been observed and studied in the gas phase for the

first time. A specially designed low-temperature absorption cell was employed in which the primary ozonide was prepared in situ by the low-temperature reaction of ozone with ethylene. An assignment of the rotational spectrum and electric dipole moment measurements have established the oxygen envelope conformation (C_s symmetry) to the lowest-energy form for the elusive chemical species.

800,285

PB88-176565 Not available NTIS
National Bureau of Standards (NML), Washington, DC.
Molecular Spectroscopy Div.

Vibrational and Electronic Spectra of the H + HCN Reaction Products Trapped in Solid Argon.

Final rept.,
M. E. Jacox. 1987, 6p
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in Jnl. of Physical Chemistry 91, n27 p6595-6600, 31 Dec 87.

Keywords: Reprints, *HCN, *Infrared spectrum, *Matrix isolation, *Normal coordinate analysis, Photolysis, Ultraviolet spectrum, Vibrational assignment.

The reaction of HCN isolated in solid argon with H atoms formed by photolysis or by a discharge leads to the stabilization of a sufficient concentration of H_2CN for observation of both its vibrational and electronic absorption spectra. Detailed isotopic substitution experiments have led to a vibrational assignment for the species. The analysis of the vibrational data is consistent with a planar molecular structure and with partial triple bond character for the CN bond. The previously reported electronic absorptions of H_2CN have been reproduced, with only a small matrix shift. The appearance of more highly excited members of the electronic band system suggests a tentative assignment of the band structure for $\text{H}_2\text{CN-dn}$. An infrared absorption that disappears on irradiation of the sample by visible light behaves appropriately for assignment to the CNH bending mode of cis- or trans- HCNH .

800,286

PB88-176573 Not available NTIS
National Bureau of Standards (NML), Washington, DC.
Molecular Spectroscopy Div.

Ammonia Dimer: Further Structural Studies.

Final rept.,
D. D. Nelson, W. Klemperer, G. T. Fraser, F. J. Lovas, and R. D. Suenram. 1987, 9p
Pub. in Jnl. of Chemical Physics 87, n11 p6364-6372, 1 Dec 87.

Keywords: *Ammonia, Reprints, *Dimers, *Hydrogen bonding, *Intermolecular potentials, *Microwave spectroscopy, Rotational spectrum, Van der Waals molecules.

New experimental results on the structural and dynamical properties of NH_3 dimer are reported in the $J=1-0$, $K=0$ transitions of $14\text{NH}_3\text{-}15\text{NH}_3$, $15\text{NH}_3\text{-}14\text{NH}_3$, ND3 dimer, and ND3-ND2H have been measured at high resolution and 14N electric quadrupole coupling constants are reported for each of these species. The NH_3 subunits comprising the dimer are inequivalent. The quadrupole coupling constant associated with the first ammonia subunit eqQ1aa , is measured in $14\text{NH}_3\text{-}15\text{NH}_3$ (-627(8)kHz), in ND3 dimer (-531(15)kHz), and in ND3-ND2H (-991(18)kHz). For the other subunit, eqQ2aa is reported in $15\text{NH}_3\text{-}14\text{NH}_3$ (892(8)kHz), in ND3 dimer (745(13)kHz), and in $\text{NH}_3\text{-}14\text{NH}_3$ (1013(18) kHz). These numbers can be used to estimate the vibrationally averaged polar angles of these isotopomers of NH_3 dimer. The result is (including the primary isotopomer) Theta 1 for $14\text{NH}_3\text{-}14\text{NH}_3$ is 48.6 deg, for $14\text{NH}_3\text{-}15\text{NH}_3$ is 48.7 deg, for ND3 dimer is 49.6 deg and for ND3-ND2H is 45.3; while Theta 2 for $14\text{NH}_3\text{-}14\text{NH}_3$ is 64.5 degrees, for $15\text{NH}_3\text{-}14\text{NH}_3$ is 64.3 deg, for ND3 dimer is 62.6 deg, and for ND3-ND2H is 65.8 deg.

800,287

PB88-176755 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Surface Science Div.

Field Emission Microscopy - Trends and Perspectives.

Final rept.,
A. J. Melmed. 1986, 35p
Pub. in Chemistry and Physics of Solid Surfaces VI, p325-359 1986.

CHEMISTRY

Physical & Theoretical Chemistry

Keywords: *Surfaces, Electron emission, Ion emission, Trends, Reprints, *Field electron microscopy, *Field ion microscopy.

Field electron and field ion microscopy are reviewed, with emphasis on their relationship and uses in surface scientific research. Historical sketches and outlines of trends in research in these microscopies are included. Some indication of possible future research directions is given.

800,288

PB88-176986

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Analysis of Collisional Alignment and Orientation Studied by Scattering of Spin-Polarized Electrons from Laser Excited Atoms.

Final rept.,
I. V. Hertel, M. H. Kelley, and J. J. McClelland. 1987, 21p
Pub. in Zeitschrift fuer Physik D: Atoms, Molecules and Clusters 6, p163-183 1987.

Keywords: *Electron scattering, Electron transitions, Excitation, Momentum transfer, Reprints, *Sodium atoms, *Electron-atom collisions, Electron spin polarization, Laser radiation.

A general framework using density matrices is developed for the analysis of atomic excitation by spin-polarized electrons. The framework is applied to the specific case of the triplet $S(1/2) \rightarrow$ triplet $P(3/2)$ transition in Na, as studied by the time-reversed, superelastic process. The scattering is characterized in terms of physical parameters describing the collisionally excited p-state, i.e., its angular momentum (L perpendicular), linear polarization, and alignment angle, with these parameters defined separately for singlet and triplet excitation. An expression for the scattering intensity is derived which is valid for arbitrary electron polarization and atomic state preparation. Specific examples are discussed with a view toward complete determination of the relevant scattering amplitudes and phases. Recent experimental results are reevaluated for comparison with theoretical calculations, and suggestions are made for future experiments.

800,289

PB88-176904

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Spin-Resolved Inverse-Photoemission Study of Ni(001) and Its Chemisorption.

Final rept.,
L. E. Klebanoff, R. K. Jones, D. T. Pierce, and R. J. Celotta. 1987, 10p
Pub. in Physical Review B 36, n15 p7849-7858, 15 Nov 87.

Keywords: *Nickel, Chemisorption, Reprints, Photoelectron spectroscopy, Electron spin polarization, Surface magnetism, Photoemission, Band theory.

Results from an angle-resolved spin-polarized inverse photoelectron spectroscopy (ARSPES) study of Ni(001), $c(2 \times 2)O/Ni(001)$, and $c(2 \times 2)S/Ni(001)$ are presented. Inverse-photoemission spectra for the clean Ni(001) surface are in good agreement with previous work. A minority-spin character is found for a direct radiative transition into an unoccupied 3d band. No definitive spin dependence is found for radiative transitions into the unoccupied 4sp band, a potentially unresolved crystal-induced surface state, or an image-potential surface state. A chemisorbed $c(2 \times 2)$ oxygen overlayer does not appreciably affect the measured spin dependence or spectral intensity of the Ni 3d radiative transition.

800,290

PB88-176961

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Accurate Rotational Constants of CO, HCl, and HF: Spectral Standards for the 0.3- to 6-THz (10- to 200-1cm) Region.

Final rept.,
I. G. Nolt, J. V. Radostitz, G. DiLorenzo, K. M. Evenson, D. A. Jennings, K. R. Leopold, M. D. Vanek, L. R. Zink, A. Hinz, and K. V. Chance. 1987, 14p
Pub. in Jnl. of Molecular Spectroscopy 125, p274-287 1987.

Keywords: *Carbon monoxide, *Hydrogen chloride, *Hydrogen fluoride, *Frequency standards, *Stand-

ards, Atmospheric composition, Far infrared radiation, Reprints, Rotational states, Calibration standards.

Accurate high-resolution spectroscopic measurements require secondary standards which can serve as convenient calibration references in laboratory and field research. The authors have measured the frequencies of a series of rotational transitions between 0.3 and 6 THz for several stable and readily obtainable gases (CO, HCl, and HF) to an accuracy better than one part in 10 million and present revised rotational constants for these molecules. The gases were selected (in part) due to their presence in the Earth's atmosphere in significant amounts and thus are convenient for the frequency calibration of atmospheric spectra.

800,291

PB88-176979

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Air- and Oxygen-Broadening Coefficients for the O₂ Rotational Line at 60.46/cm-1.

Final rept.,
D. A. Jennings, K. M. Evenson, M. D. Vanek, I. G. Nolt, J. V. Radostitz, and K. V. Chance. 1987, 4p
Contract NASA-W-15047
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Geophysical Research Letters 14, n7 p722-725 Jul 87.

Keywords: *Oxygen, Infrared spectroscopy, Far infrared radiation, Stratosphere, Air, Reprints, Line broadening, Rotational states, Pressure effects.

Using an NBS laser-based tunable far infrared spectrometer, the authors have measured the air- and oxygen-broadening coefficients for the $J = 10 \rightarrow 11$, $N = 11 \rightarrow 9$ O₂ rotational transition at 60.46/cm (1.812 THz). These direct experimental measurements of the air-broadening coefficient should improve the accuracy of retrieval calculations for far infrared stratospheric balloon experiments which use O₂ rotational lines to calibrate the viewing geometry.

800,292

PB88-176987

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Quantum Jumps via Spontaneous Raman Scattering.

Final rept.,
R. G. Hulet, and D. J. Wineland. 1987, 5p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC, and Office of Naval Research, Arlington, VA.
Pub. in Physical Review A 36, n6 p2758-2762, 15 Sep 87.

Keywords: Atomic spectroscopy, Atoms, Reprints, *Resonance fluorescence, Laser radiation.

A single laser, which is used to induce and detect spontaneous Raman transitions, can be used to observe quantum jumps in a single atom. The population dynamics of a particular system, consisting of two doublet $S(1/2)$ ground-state levels and four doublet $P(3/2)$ excited-state levels split by a magnetic field, is analyzed for a laser tuned near a particular transition. The authors find that the statistics of the fluorescence emitted by the system are described by the same formalism developed for the three-level V configuration irradiated by two light sources. Over a wide range of observation times, the fluorescence intensity will be two valued, either off or on, as has been verified for the V configuration. Some surprising and elegant features of the new system are described.

800,293

PB88-176995

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Stark Spectroscopy Using Tunable Far-Infrared Radiation.

Final rept.,
L. R. Zink, D. A. Jennings, K. M. Evenson, A. Sasso, and M. Inguscio. 1987, 4p
Contract NASA-W-15047
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of the Optical Society of America B 4, n7 p1173-1176 Jul 87.

Keywords: *Molecular spectroscopy, *Infrared spectroscopy, Far infrared radiation, Methyl alcohol, Dipole moments, Reprints, Methanols.

The authors report on an experimental demonstration of molecular Stark spectroscopy based on the use of tunable far-infrared radiation at 0.91 THz. The radiation was generated by the nonlinear mixing of the radiation from two CO₂ lasers in a point-contact metal-insulator-metal diode. The technique is used to make the first reported measurement of the permanent dipole moment of (13)CH₃OH; $\mu_{\text{sub } a} = 0.883(25)$ D.

800,294

PB88-177019

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Measurement of the Universal Gas Constant R Using a Spherical Acoustic Resonator.

Final rept.,
M. R. Moldover, J. P. M. Trusler, T. J. Edwards, J. B. Mehl, and R. S. Davis. 1988, 4p
Pub. in Physical Review Letters 60, n4 p249-252, 25 Jan 88.

Keywords: *Fundamental constants, Acoustic resonators, Acoustic velocity, Argon, Temperature measurement, Reprints, *Universal gas constant, *Gas constant.

The authors report a new value for the universal gas constant R : 8.314471 ± 0.000014 J/mol/K. The standard error of R has been reduced by a factor of 5, to 1.7 ppm. R was determined from the speed of sound in argon contained with a thick, spherical shell at the temperature of the triple point of water $T(t)$. The volume of the shell was measured by their weighing the mercury required to fill it at $T(t)$. The molar mass of the argon was determined relative to that of a standard with accurately known chemical and isotopic composition by use of speed-of-sound data.

800,295

PB88-177027

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Heat Capacity and Electrical Resistivity of Liquid Niobium Near Its Melting Temperature.

Final rept.,
A. Cezairliyan, and J. L. McClure. 1987, 6p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in International Jnl. of Thermophysics 8, n6 p803-808 Nov 87.

Keywords: *Niobium, *Liquid metals, *Electrical resistivity, *Specific heat, Reprints, *Liquid niobium, High temperature, Transients.

A microsecond-resolution capacitor discharge technique is used to heat niobium specimens rapidly to temperatures several hundred degrees above the melting point. From the measurements of current, voltage, and temperature as a function of time, the heat capacity and electrical resistivity of liquid niobium in the range 2850 to 3200 K were determined. Maximum uncertainties in the results are estimated to be $\pm 5\%$ for heat capacity and $\pm 3\%$ for electrical resistivity.

800,296

PB88-177431

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Spectra and Energy Levels of Ions in the Zinc Isoelectronic Sequence from Rb VIII to Mo XIII.

Final rept.,
U. Litzen, and J. Reader. 1987, 11p
Sponsored by Swedish Natural Science Research Council, Stockholm, Department of Energy, Washington, DC. Office of Magnetic Fusion Energy, and Naval Research Lab., Washington, DC.
Pub. in Physical Review A 36, n11 p5159-5169, 1 Dec 87.

Keywords: *Ions, Reprints, *Energy levels, *Molybdenum, *Niobium, *Rubidium, *Spectrum, *Strontium, *Vacuum ultraviolet, *Zinc isoelectronic sequence, *Zirconium.

Spectra of the zinclike ions Rb VIII, Sr IX, Y, Zr XI, Nb XII, and Mo XIII were excited with sparks and laser-produced plasmas and observed with normal- and grazing-incidence vacuum spectrographs. Almost all levels of the 4s₂, 4s4p, 4p₂, 4s4d, 4s5s, 4p5p, 4s5s and 4s5d configurations were established in these ions. Several 4s4f3F-4s5g3G transitions of Nb XII and Mo XIII were also identified. The observed energy

levels were interpreted by means of least-squares parametric fits and Hartree-Fock calculations. The ionization energies were determined as 132.79(25) eV for Rb VIII, 158.33(25) eV for Sr IX, 185.77(37) eV for Y x, 214.86(37) eV for Zr XI, 246.11(37) eV for Nb XII, and 279.09(50) eV for Mo XIII.

800,297

PB88-178488

Not available NTIS

National Bureau of Standards (NML), Washington, DC. Molecular Spectroscopy Div.

New Measurements of Microwave Transitions in the Water Dimer.

Final rept., L. H. Coudert, F. J. Lovas, R. D. Suenram, and J. T. Hougen. 1987, 10p
Pub. in Jnl. of Chemical Physics 87, n11 p6290-6299, 1 Dec 87.

Keywords: Reprints, *Water dimer, *Microwave transitions, *Tunneling splittings, Stark coefficients, Supersonic beam, Fourier transform microwave spectrometer, Thermal relaxation.

New measurements of ten $K = 1$ lines, including six Q type and four R type, were made on the completely protonated species of the water dimer. For some of these lines, as well as for some $K = 0$ transitions known from the literature, Stark coefficients were determined, and these Stark coefficients provide a confirmation of the assignments. The new $K = 1$ measurements show that the splitting associated with the (HF)₂-like tunneling motion decreases from about 19.5 GHz for $K = 0$ to about 16.2 GHz for $K = 1$. To understand the fact that $K = 1$ lines are populated in our 1 K beam, the authors must assume, in accordance with the results of beam studies on other molecules, that levels of different nuclear spin modification relax separately. In an attempt to gain information on tunneling splittings other than that caused by the (HF)₂-like motion, the authors have made new measurements on 1-0 and 2-1 transitions with $K = 0$ for several partially deuterated species, in which the (HF)₂-like motion cannot occur. Small splittings ranging from 4 to 145 MHz were observed. Because of the nature of the tunneling motions involved, these new data yield only the difference of the tunneling splitting in the upper and lower states of the transition.

800,298

PB88-178512

Not available NTIS

National Bureau of Standards (NML), Washington, DC. Molecular Spectroscopy Div.

Microwave Spectrum of Formamide-Water and Formamide-Methanol Complexes.

Final rept., F. J. Lovas, R. D. Suenram, G. T. Fraser, C. W. Gillies, and J. Zozom. 1988, 8p
Pub. in Jnl. of Chemical Physics 88, n2 p722-729, 15 Jan 88.

Keywords: Reprints, *Hydrogen bonding, *Formamide water, Formamide methanol, *Microwave spectrum, Molecular beam, Rotational spectra.

The microwave spectra of the formamide-water and formamide-methanol complexes have been investigated with a pulsed beam Fabry-Perot cavity Fourier transform microwave spectrometer. The observed hyperfine structure due to the 14N nuclear quadrupole interaction was used to assign the rotational transitions for both species. For formamide-water the rotational analysis of ten transitions provides the constants: $A = 11\ 227.931(1)$ MHz, $B = 4586.9628(10)$ MHz, $C = 3258.8278(7)$ MHz, $eQq_a = 1.332(3)$ MHz, and $eQq_b = 2.037(3)$ MHz. The formamide-methanol spectrum exhibits an additional splitting from internal rotation of the methyl group. Eighteen observed transitions from the A and E symmetry states have been assigned and fitted with the rotational constants: $A = 10\ 186.594(6)$ MHz, $B = 2090.36(59)$ MHz, and $C = 1762.80(56)$ MHz with hyperfine constants close to those of formamide-water. By assuming a methyl top moment of inertia $I_a = 3.206\ uA^2$, the barrier to internal rotation $V_3 = 231.01(17)$ cm⁻¹ is obtained. The barrier height is about 36% smaller than that of methanol. The structures determined for these complexes agree well with prior ab initio calculations which indicate essentially planar, double hydrogen bonded structures for both species.

800,299

PB88-187539

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Absolute Cross-Section Measurements for Electron-Impact Ionization of Al(1+), Cd(1+), and Hg(1+).

Final rept., D. S. Belic, R. A. Falk, C. Timmer, and G. H. Dunn. 1987, 9p
Sponsored by Department of Energy, Washington, DC. Pub. in Physical Review A 36, n3 p1073-1081, 1 Aug 87.

Keywords: Ionization, Electron irradiation, Reprints, *Electron-ion collisions, *Aluminum ions, *Cadmium ions, *Mercury ions, *Ionization cross sections.

Absolute cross sections for single ionization of Al(1+), Cd(1+), and Hg(1+) by electron impact have been measured for electron energies from threshold to 2 keV using the crossed-beams technique. Comparisons are made to semiempirical and theoretical predictions and to other existing experimental data.

800,300

PB88-187570

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Direct Observation of Ba(1+) Velocity Distributions in a Drift Tube Using Single-Frequency Laser-Induced Fluorescence.

Final rept., R. A. Dressler, H. Meyer, A. O. Langford, V. M. Bierbaum, and S. R. Leone. 1987, 2p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 87, n9 p5578-5579, 1 Nov 87.

Keywords: *Ions, *Lasers, Mobility, Velocity, Reprints, *Barium.

First results are presented on velocity distribution measurements of Ba(1+) ions drifted in helium using a well-characterized flow tube and single-frequency laser-induced fluorescence detection. Reduced mobilities of Ba(1+) in helium are obtained for E/N values between 4.67 and 18.7 Td. The velocity distributions that are observed parallel to the electric field fit a displaced maxwell-boltzmann distribution, in agreement with theoretical predictions.

800,301

PB88-187588

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Distorted-Wave Calculations of the Electron-Impact Ionization of Highly Ionized Na-Like Ions.

Final rept., D. C. Griffin, M. S. Pindzola, and C. Bottcher. 1987, 12p
Contract DE-AC05-84OR21400
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Physical Review A 36, n8 p3642-3653, 15 Oct 87.

Keywords: *Ionization, Electron irradiation, Reprints, *Electron-ion collisions, *Titanium ions, *Chromium ions, *Iron ions, *Nickel ions.

Distorted-wave calculations of the electron-impact ionization cross sections and rate coefficients for the Na-like ions Ti(11+), Cr(13+), Fe(15+), and Ni(17+) are reported.

800,302

PB88-187596

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Nonunity I* Quantum Yield in the 193-nm Photodissociation of Methyl Iodide.

Final rept., W. P. Hess, R. Naaman, and S. R. Leone. 1987, 3p
Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Jnl. of Physical Chemistry 91, n24 p6085-6087 1987.

Keywords: Reprints, Diode lasers, *Iodine, Methyl iodide, *Photodissociation, Quantum yield.

The I asterisk quantum yield of CH₃I at 193 nm is determined to be 70 plus or minus 4% by the diode laser gain versus absorption technique. The value is lower than the 100% I asterisk yield determined from the analysis of molecular beam time-of-flight results. A critical evaluation of the gain versus absorption technique

is presented and the possible sources of the discrepancy between the two results are discussed.

800,303

PB88-187604

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Excitation of N₂ in DC Electrical Discharges at Very High E/n.

Final rept., B. M. Jelenkovic, and A. V. Phelps. 1987, 17p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Physical Review A 36, n11 p5310-5326, 1 Dec 87.

Keywords: *Nitrogen, Electric discharges, Gas discharges, Electric fields, Direct current, Excitation, Gas ionization, Reprints.

Spatial distributions of light emission from electric discharges in N₂ have been measured at very high electric-field-to-gas-density ratios E/n and low gas densities.

800,304

PB88-187638

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Molecular Scattering and Vibrational Spectroscopy at Surfaces: A Dynamic Symbiosis.

Final rept., J. W. Gadzuk. 1987, 10p
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 45, p371-380 1987.

Keywords: Molecular beams, Surfaces, Infrared spectroscopy, Reprints, *Molecule collisions, Vibrational states, Chaos.

Controlled chemical dynamics at surfaces involves the movement of selected atoms of the constituent molecules and solid over multi-dimensional potential energy surfaces (PES). State-to-state molecular beam scattering and vibrational spectroscopy provide complementary information about the PES over which the hoped for controlled dynamics occurs. In the work, quantitative techniques developed in non-linear dynamics are used to demonstrate the symbiotic relationship between scattering and spectroscopy.

800,305

PB88-187661

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Observation of Quantum Jumps in Hg(1+).

Final rept., W. M. Itano, J. C. Bergquist, R. G. Hulet, and D. J. Wineland. 1987, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Laser Spectroscopy VIII, p117-120 1987.

Keywords: Reprints, *Mercury ions, Radiative decay, Branching ratio, Laser spectroscopy, Ion traps, Laser induced fluorescence.

Quantum jumps are observed in isolated samples of one or a few Hg(1+) ions stored in an ion trap. The jumps are observed as sudden changes in the laser-induced fluorescence. Analysis of the statistical properties of the quantum jumps yields values for the radiative lifetimes of the metastable 5d(9) 6s(2) doublet D(3/2) and 5d(9) 6s(2) doublet D(5/2) states and for the branching ratio of the decay modes of the doublet D(3/2) state. The bistable nature of the fluorescence from a single ion is used to improve the signal-to-noise ratio in optical-optical double-resonance.

800,306

PB88-187687

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Characterization of Flame Spread Over PMMA (Poly(methylmethacrylate)) Using Holographic Interferometry Sample Orientation Effects.

Final rept., A. Ito, and T. Kashiwagi. 1988, 16p
Pub. in Combustion and Flame 71, p189-204 1988.

Keywords: Temperature, Reprints, *Flame spread, *Holographic interferometry, Poly(methyl methacrylate), Refractive indexes.

Flame spread over a thermally thick slab of PMMA at several angles of sample orientation from $\theta = -90$ degs (vertically downward flame spread) to $\theta = +90$ degs (vertically upward flame spread) in air was investigated by measuring temperature distributions within the PMMA sample in the vicinity of the leading edge of the flame front using holographic interferometry. Samples with widths of 0.32, 0.47, 1.0, and 2.5 cm, a thickness of 2.5 cm, and a length of 30 cm were used. The measured net heat flux from the gas phase to the sample surface at the vaporization front of the sample is about 7 W/sq. cm. for downward flame spread ($\theta < 0$ degs), 6.5 W/sq. cm. at $\theta = +10$ degs, and 2.8 W/sq. cm. at $\theta = +90$ degs. However, the total net heat transfer rate increases with an increase in the angle of sample orientation, because the characteristic heating length, defined as the distance from the adiabatic point on the sample surface to the vaporization point, increases with an increase in the orientation angle of the sample. The total net heat transfer rate into the sample from the gas phase is about 56% of the total net heat transfer input to the sample at $\theta = -90$ degs, 78% at $\theta = 0$ degs, 87% at $\theta = +10$ degs, and 99% at $\theta = +90$ degs. Therefore, heat transfer from the gas phase into the unburnt fuel ahead of the vaporization point is the dominant heat transfer path for all angles of orientation. This was clearly demonstrated by the net heat flow vector patterns within the sample. The streamwise conductive heat transfer rate through the sample decreases with an increase in flame spread rate (increase in the sample orientation angle) due to insufficient time being available for the slow thermal wave to travel through the sample.

800,307
PB88-187695 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Office of Nondestructive Evaluation.
About an Information Theoretical Spectral Line Shape Proposed for the Collision Induced Spectroscopies.
Final rept.,
M. S. Brown, L. Frommhold, and G. Birnbaum. 1987, 11p
Grant NSF-AST83-10786
Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in *Molecular Physics* 62, n4 p907-917 1987.

Keywords: *Spectral lines, Infrared spectra, Far infrared radiation, Infrared spectroscopy, Reprints.

The authors investigated the use of translational lineshapes generated from information theory (IT) for collision induced spectroscopies. In several cases of general interest, they found that such IT lineshapes fail to adequately approximate exact lineshapes computed from fundamental theory. The IT profiles are associated with poorly defined parameters, and thus have at best a marginal ability to represent collision induced spectra; other lineshape models are known which provide better approximations to exact lineshapes.

800,308
PB88-188479 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Radiative Decay Rates in $\text{Hg}(1+)$ from Observations of Quantum Jumps in a Single Ion.
Final rept.,
W. M. Itano, J. C. Bergquist, R. G. Hulet, and D. J. Wineland. 1987, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in *Physical Review Letters* 59, n24 p2732-2735, 14 Dec 87.

Keywords: Reprints, *Mercury ions, *Radiative decay, Laser induced fluorescence, Laser spectroscopy, Branching ratio, Mercury 198.

Radiative decay rates connecting the lowest four energy levels of $(198)\text{Hg}(1+)$ have been derived solely from an analysis of the fluctuations (quantum jumps) of the laser induced fluorescence of the 194-nm first resonance transition of a single ion confined in a Paul trap. The natural linewidth of the 194-nm first resonance transition was also measured. The measured decay rates and branching ratios are in satisfactory agreement with theory.

800,309
PB88-188487 Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Sub-Doppler Tunable Far-Infrared Spectroscopy.
Final rept.,
M. Inguscio, L. R. Zink, K. M. Evenson, and D. A. Jennings. 1987, 3p
Contract W-15047
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in *Optics Letters* 12, n11 p867-869 Nov 87.

Keywords: *Methyl alcohol, *Infrared spectroscopy, Far infrared radiation, Carbon dioxide lasers, Line width, Reprints, *Methanols, Vibrational states, Laser radiation.

The first experimental observations, to the authors knowledge, of sub-Doppler linewidths in a cell made using tunable far-infrared radiation are reported. A double-resonance scheme has been used, combining CO₂-laser infrared radiation with tunable far-infrared radiation to observe a sub-Doppler line shape in an excited vibrational state of CH₃OH.

800,310
PB88-189063 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Theoretical Calculations of Indirect Processes in Electron-Impact Ionization of Atomic Ions.
Final rept.,
M. S. Pindzola, D. C. Griffin, and C. Bottcher. 1987, 15p
Pub. in *Comments on Atomic and Molecular Physics* 20, n6 p337-351 1987.

Keywords: *Ionization, Electron irradiation, Reprints, *Electron-ion collisions.

The application of continuum Hartree-Fock theory to the calculation of indirect processes in the electron-impact ionization of atomic ions is reviewed. Comparison between theory and recent crossed-beams experiments is made for several multiply charged atomic ions.

800,311
PB88-189071 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Simplified Models of Electron Excitation and Ionization at Very High E/n.
Final rept.,
A. V. Phelps, B. M. Jelenkovic, and L. C. Pitchford. 1987, 10p
Sponsored by Air Force Geophysics Lab., Hanscom AFB, MA.
Pub. in *Physical Review A* 36, n1 p5327-5336, 1 Dec 87.

Keywords: Models, Reprints, Current, Discharges, *Electron excitation, Electron motion, *Ionization.

Models of electron excitation and ionization at very high electric-field-to-gas-density ratios E/n are compared under conditions appropriate to discharge experiments at low gas densities, such as those in N₂ described in the preceding paper. The models considered use the monoenergetic beam approximation in a velocity moment technique for solution of the electron Boltzmann equation. They differ in the treatment of the electrons produced by ionization and in the use of either the momentum balance or the energy balance to obtain the effective frictional effect. A simplified single-beam model is found to agree reasonably well with multiple-beam models, with the few published Monte Carlo results, and with experimentally measured spatial ionization coefficients.

800,312
PB88-189105 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Hindered Internal Rotation in Jet Cooled H₂HF Complexes.
Final rept.,
C. M. Lovejoy, D. D. Nelson, and D. J. Nesbitt. 1987, 8p
Grants NSF-CHE86-05970, NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in *Jnl. of Chemical Physics* 87, n10 p5621-5628, 15 Nov 87.

Keywords: *Hydrogen fluoride, Hydrogen inorganic compounds, Reprints, *Predissociation, Slit jet expansion, Tunnelling.

The vibration-rotation spectrum of the HF stretch mode in ortho-H₂HF complexes has been obtained via infrared laser direct absorption detection in a slit supersonic jet expansion. The spectrum resembles a $K(\text{sub } a) = 1 < -1$ parallel band of a prolate near-symmetric top and can be reasonably well fit with a Watson A-type Hamiltonian; however, no rigid molecular structure can reproduce the observed $K(\text{sub } a)$ splittings without invoking unphysically large changes in the constituent bond lengths upon complexation. The splittings are more correctly analyzed in terms of a $j=1$ hindered H₂ rotor in an anisotropic potential, with a minimum energy T-shaped geometry. Matrix calculations determine barriers to H₂ rotation between 120 and 170/cm that depend systematically both on vibrational and rotational state in the complex. These data are consistent with a strong increase in potential anisotropy with decreasing intermolecular separation, with both upper and lower vibrational states close to the dissociation limit. The results provide direct evidence for vibrationally averaged structure, internal rigidity, and intermolecular bond strength that are significantly quantum state dependent, but can be qualitatively understood in terms of simple steric interactions between the H₂ and HF subunits.

800,313
PB88-189139 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Double Auger Processes in the Electron-Impact Ionization of Lithium-Like Ions.
Final rept.,
M. S. Pindzola, and D. C. Griffin. 1987, 5p
Pub. in *Physical Review A* 36, n6 p2628-2632, 15 Sep 87.

Keywords: *Ionization, Electron irradiation, Reprints, *Electron-ion collisions, *Oxygen ions, *Auger effect.

Contributions to the electron-impact ionization of Li-like ions, due to resonant recombination followed by double Auger emission, are calculated using first- and second-order perturbation theory.

800,314
PB88-189147 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Recent Advances Using ESDIAD (Electron Stimulated Desorption Ion Angular Distributions): Applications to Surface Chemistry.
Final rept.,
T. E. Madey, C. Benndorf, and N. D. Shinn. 1985, 12p
Pub. in *Springer Ser. Surf. Sci.* 4, p104-115 1985.

Keywords: *Surface chemistry, Chemisorption, Desorption, Chemical reactivity, Reprints, *ESDIAD method.

Recent applications of ESDIAD (electron stimulated desorption ion angular distributions) to surface chemistry are described. Examples include the influence of catalytic promoters and poisons on surface structure and reactivity, the evidence for a new structural form for adsorbed H₂O (i.e., H₂O dimers on Ni(110)), and the characterization of a new bonding mode for CO on Cr(110). Calculations of the perturbing influence of image force and reneutralization effects in ESDIAD are described.

800,315
PB88-189170 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Mechanisms and Applications of Electron Stimulated Desorption in Surface Science.
Final rept.,
T. E. Madey. 1987, 3p
Pub. in *Vacuum* 37, n1-2 p31-33 1987.

Keywords: *Surface chemistry, Chemisorption, Reprints, *Electron stimulated desorption, ESDIAD method.

The principles and mechanisms of electron stimulated desorption (ESD) and the utility of the electron stimulated desorption ion angular distribution (ESDIAD) method as a tool for determining the structure of surface molecules have been described in several recent books and review articles. The present note is intended to provide a guide to the relevant literature, and to outline briefly some recent work relating to the uses of

ESDIAD for determining the structure of surface molecules.

800,316

PB88-189220

Not available NTIS

National Bureau of Standards (NML), Washington, DC. Molecular Spectroscopy Div.

Rotational Constants of the Lowest Torsional Component (0G) of the Ground State and Lowest Torsional Component (1G) of the First Excited Torsional State of Hydrogen Peroxide.

Final rept.,

W. B. Olson, R. H. Hunt, B. W. Young, A. G. Maki, and J. W. Brault. 1988, 23p

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in Jnl. of Molecular Spectroscopy 127, p12-34 1988.

Keywords: Reprints, *Hydrogen peroxide, Torsion, *Rotational constants, Torsional rotational interaction constants, Asymmetric rotor.

New high-resolution spectra of hydrogen peroxide has been taken in the OH stretching region and in the overtone-combination region of the OOH bends. Ordinary combination differences in the (0G) and (1G) torsional states and directly obtained energy level differences between these torsional states have been supplemented with combination differences obtained from previously published microwave data and fitted to obtain the rotational constants of the two torsional states and the parameter characterizing the perturbation between them. A simplified notation scheme for the vibrational-torsional-rotational levels, the transitions used to obtain direct energy level differences between levels of the (0G) and (1G) torsional states, and the specific Hamiltonian used are described in the text. A table of rotational and interaction constants is given, and also tables of the actual (perturbed) rotational levels in the (0G) and (1G) torsional states.

800,317

PB88-189311

Not available NTIS

National Bureau of Standards (NML), Washington, DC. Molecular Spectroscopy Div.

Determination of the Structure of OCS CO₂.

Final rept.,

S. E. Novick, R. D. Suenram, and F. J. Lovas. 1988, 4p

Pub. in Jnl. of Chemical Physics 88, n2 p687-690, 15 Jan 88.

Keywords: *Carbon dioxide, Microwaves, Reprints, Carbonyl sulfide, Dipole moment, Rotational spectrum, *Structures.

The rotational spectrum of the weakly bound complex OCS CO₂ has been measured using a pulsed beam Fourier transform microwave spectrometer. The rotational constants of the major isotopomer are $A = 4454.606$ MHz, $B = 1517.778$ MHz, and $C = 1129.666$ MHz. The molecule is planar with a 'slipped near parallel' structure analogous to the structure of the dimer of carbon dioxide. The sulfur atom occupies the 'inner' position; this is the obtuse rather than the acute vertex of the O-O-C-S quadrangle. The distance from the center-of-mass (c.m.) of CO₂ to the c.m. of OCS is 3.552 Å.

800,318

PB88-189550

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Thermodynamic Paradox Associated with Non-classical Critical Phenomena in Mixtures.

Final rept.,

J. C. Wheeler, G. Morrison, and R. F. Chang. 1985, 7p

Pub. in Jnl. of Chemical Physics 83, n11 p5837-5843 1985.

Keywords: Reprints, *Critical phenomena, Griffiths-Wheeler, Non classical critical phenomena, *Non-unique phase diagrams, Phase diagrams.

Non-classical (or non van der Waals) critical points are characterized by exponents that relate the values of properties of a material near a critical point that are different from those predicted by the van der Waals equation of state. Certain quantities that have finite values in van der Waals fluids are weakly infinite in non-classical fluid models. These weak infinities can force the coefficient of thermal expansion to become negative over small temperature ranges when the critical locus of a mixture has a negative value for dP/dT .

The paper describes the consequences of such a condition when the properties of such a material are represented in poorly chosen thermodynamic spaces.

800,319

PB88-189675

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.

Limits of Stability of the Extended Water Model.

Final rept.,

E. Van Royen, and P. H. E. Meijer. 1986, 18p

Pub. in Physica A 139A, n2-3 p412-429 Dec 86.

Keywords: Water, Reprints, *Hydrogen bonds, Lattice models, *Metastable state, Spinodal, Undercooling.

In the paper the authors report the metastable states of the extended water model. The framework of the computations is explained in detail; the constrained or 'observed' variables are determined as function of the non-observed order parameters, or cluster variables, and the susceptibility is expressed in terms of the Hessian of the free energy with respect of these constrained variables. Since the Hessian is of the fourth order in the model, there are different possibilities for it to be zero, each associated with a different spinodal. The analysis of the problem was done and examples are given. The procedure used is compared with Gibbs original work on the equilibrium of heterogeneous substances.

800,320

PB88-189691

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Experience with the Use of a Neutron Protein Data Collection Facility Equipped with a Linear Detector.

Final rept.,

A. Wlodawer, and L. Sjolín. 1986, 7p

Pub. in Jnl. of Phys. Colloq. 47, nC-5, p115-121 Aug 86.

Keywords: Instrumentation, Insulin, Reprints, *Diffraction data collection, *Protein crystallography, Ribonuclease, Trypsin inhibitor.

A neutron protein data collection facility equipped with a linear detector has been in operation for about 5 years and has been used to measure diffraction data from crystals of three proteins. Computational methods have been developed for integrating reflection intensities using a dynamic mask procedure, for measuring and applying an absorption correction and for improving the orientation matrix. The data are of acceptable quality, with symmetry R factors ranging from 0.04 to 0.12. These data were used in several successful structure determinations.

800,321

PB88-189717

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Kinetics of One-Electron Oxidation by the C10 Radical.

Final rept.,

Z. B. Alfassi, R. E. Huie, S. Mosseri, and P. Neta.

1988, 4p

Sponsored by Department of Energy, Washington, DC. Pub. in Radiation Physics and Chemistry 32, n1 p85-88 1988.

Keywords: Reprints, *Dimethoxybenzene, Hypochlorite ion, Phenols, *Pulse radiolysis, *Rate constants.

Pulse radiolysis studies were carried out to determine the rate constants for reactions of ClO radicals in aqueous solution. These radicals were produced by the reaction of OH with hypochlorite ions in N₂O saturated solutions. The rate constants for their reactions with several compounds were determined by following the build up of the product radical absorption and in several cases by competition kinetics. ClO was found to be a powerful oxidant which reacts very rapidly with phenoxide ions to form phenoxyl radicals and with dimethoxybenzenes to form the cation radicals. ClO also oxidizes ClO(2-) and N(3-) ions rapidly, but its reactions with formate and benzoate ions were too slow to measure. ClO does not oxidize carbonate but the CO(3-); radical reacts with ClO(1-) slowly.

800,322

PB88-189725

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Rate Constants for F(1-) Transfer from SF₆(1-) to Fluorinated Gases and SO₂. Temperature Dependence and Implications for Electrical Discharges in SF₆.

Final rept.,

L. W. Sieck, and R. J. Van Brunt. 1988, 6p

Sponsored by Department of Energy, Washington, DC. Pub. in Jnl. of Physical Chemistry 92, n3 p708-713, 11 Feb 88.

Keywords: Reprints, *Electric discharges, *Gas phase, Heats of formation, Negative ions, Sulfur hexafluoride.

The reactivity of SF(6-) toward SO₂, SOF₂, SO₂F₂, SOF₄, SF₄, and SiF₄ has been investigated by using the technique of pulsed electron beam high-pressure mass spectrometry. These studies were initiated in order to probe the complex anionic chemistry occurring during electrical discharge in SF₆. Although no reaction of any type was observed with SOF₂ and SO₂F₂, efficient F(1-) transfer of the type SF(6-) + A -> AF(1-) + SF₅ was found in all of the other systems including the SO₂F(1-) + SOF₄ pair, which was studied separately. With the exception of the SF(6-) + SiF₄ reaction, all of the pairs exhibited a negative temperature coefficient in that the rate constants for F-transfer decreased substantially with increasing temperature. The reaction SF(6-) + A -> AF(1-) + SF(5) was found to proceed with a rate constant of 5.6 plus or minus .8 times 10 to the minus 10th power cu.cm. (molecule x s) throughout the temperature range studied (298-510 K), which corresponds to a collision efficiency of unity. The other reactions were found to approach unit collision efficiency only at reduced temperatures (<300 K). The reactions studied were used to provide additional information concerning the gas-phase F(1-) affinity scale, and the F(1-) affinity of SiF₄ was defined as 2.2 plus or minus 0.4 kcal/mol higher than SOF₄ via equilibria measurements. The placement of SF₅ within the F(1-) affinity scale indicates that SF(6-) is reactive toward several of the major stable byproducts generated during electrical breakdown in SF₆. This behavior was verified by direct observation of the temporal growth and decay profiles of the various anions produced after pulsed ionization of an SF₆ sample which had been subjected to prior partial decomposition in a negative corona discharge. Some comments are also included concerning the stability of the SF(6-) x SF₆ dimer ion, and the implications of all the present data with respect to mobility measurements in SF₆ are also discussed.

800,323

PB88-189733

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

High Temperature Stabilities of Hydrocarbons.

Final rept.,

S. E. Stein, and A. Fahr. 1985, 12p

Pub. in Jnl. of Physics and Chemistry 89, n17 p3714-3725, 15 Aug 85.

Keywords: Reprints, *Thermodynamics, Equilibria, *High temperature, *Hydrocarbon stability, Soot formation.

A chemical thermodynamic analysis of hydrocarbon molecules from 1500 K to 3000 K is presented for species C₂nH₂m, n = 1-21, m = 1-8. Using group additivity as the primary estimation method, the nature and chemical thermodynamic properties of the most stable molecules are found. Concentrations of these molecules are then examined in equilibrium with acetylene and molecular hydrogen after taking into account numbers of isomers. Thermodynamically favored pathways leading to large polyaromatic species are examined in detail. Two general types of paths are found. At higher H₂/C₂H₂ ratios (greater than or equal to 1), most species on these paths are polycyclic aromatic molecules and, depending on partial pressures of C₂H₂ and H₂, a barrier appears in the range 1400-1800 K which increases sharply with increasing temperature. At lower H₂/C₂H₂ ratios, many smaller species are acyclic and as this ratio becomes smaller the barrier declines and becomes less sensitive to temperature. A discussion of the relation between these results and the kinetics of carbon polymerization is then presented using the acetylene pyrolysis system as a model.

800,324

PB88-189816

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

CHEMISTRY

Physical & Theoretical Chemistry

Autodetachment Spectroscopy and Dynamics of CH₂CN(1-) and CD₂CN(1-).

Final rept.,
K. R. Lykke, D. M. Neumark, T. Andersen, V. J. Trapa, and W. C. Lineberger. 1987, 12p
Grants NSF-CHE83-16628, NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in *Jnl. of Chemical Physics* 87, n12 p6842-6853, 15 Dec 87.

Keywords: *Electronic spectra, Excitation, Reprints, *Autodetachment spectroscopy, Electron affinity, Rotation electronic coupling.

The technique of autodetachment spectroscopy is utilized in a study of two electronic states of CH₂CN(1-) and CD₂CN(1-). The ground electronic state is a normal valence state while the outermost electron in the excited state is bound by the dipole moment of the neutral radical. Autodetachment occurs from excited rotational levels of the dipole bound state, giving some 5000 sharp features near the photodetachment threshold. All of these features were assigned and spectroscopic constants for both states are reported. The binding energy of the electron in the latter state is determined to be greater than or approximately 66/cm and analysis of the autodetachment spectrum shows the electron affinities of CH₂CN(1-) and CD₂CN(1-) to be approx. 12 500 and approx. 12 430/cm, respectively. The dynamics of the autodetachment process is studied and various mechanisms for detachment are described.

800,325

PB88-189899

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Dynamics of Concentration Fluctuation in a Polymer Blend on Both Sides of the Phase Boundary.

Final rept.,
T. Sato, and C. C. Han. 1988, 9p
Pub. in *Jnl. of Chemical Physics* 88, n3 p2057-2065, 1 Feb 88.

Keywords: Diffusion, Temperature, Reprints, *Spinodal decomposition, *Polymer blend, *Concentration fluctuation, Scattering.

The dynamics of concentration fluctuation in a deuterated polystyrene/poly(vinylmethylether) blend system has been studied by the temperature jump and also by the reverse quench light scattering techniques. The growth or decay rate $R(q)$ in Cahn-Hilliard-Cook's equation is almost proportional to the square of scattering wave vector. This indicates that the interfacial free energy contribution to the concentration fluctuation dynamics in the wavelength range examined is very small. The interdiffusion coefficient D which has been obtained as a function of temperature, is continuous at the phase separation boundary. The mobility M , which can be extracted from D by combining the results of both statics and kinetics has an Arrhenius type of temperature dependence on both sides of the phase boundary.

800,326

PB88-190137

Not available NTIS
National Bureau of Standards (NML), Washington, DC. Molecular Spectroscopy Div.

Rovibrational Analysis of the (nu sub 5, sup 1) Vibrational Band in the HCN...HF Hydrogen-Bonded Cluster.

Final rept.,
B. A. Wofford, J. Bevan, W. B. Olson, and W. J. Lafferty. 1986, 4p
Pub. in *Chemical Physics Letters* 124, n6 p579-582, 14 Mar 86.

Keywords: Reprints, Frequency shifts, *Hydrogen bonding, Infrared spectrum, *Rotational analysis, Spectroscopic constants, HCN...HF cluster.

The authors report here the observation and analysis of rotational structure in the upsilon 5(1) fundamental (arising from the HCN intramolecular bending vibration) of HCN...HF. The investigation completes the determination of the intramolecular fundamental frequencies in the cluster, enabling accurate evaluation of the vibrational frequency shifts upon complex formation. The results are compared with the predictions of ab initio molecular orbital calculations.

800,327

PB88-190152

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Interfacial Equilibrium during a First-Order Phase Transformation in Solids.

Final rept.,
P. W. Voorhees, and W. C. Johnson. 1986, 14p
Pub. in *Jnl. of Chemical Physics* 84, n9 p5108-5121, 1 May 86.

Keywords: Stress, Reprints, Coherency, Interface, *Phase transformation, Precipitate, Thermodynamics, *Solids.

A continuum thermodynamic treatment of the local equilibrium concentration at a two-phase interface during a first-order phase transition in crystalline solids is presented. It is assumed that the second-phase domain has a spherical morphology, is coherent with the matrix, and possesses different elastic constants than the matrix. It is shown that the equilibrium concentration at the solid-solid interface is strongly coupled to the stress states of the matrix, precipitate, and interface as well as the interfacial curvature. The relationship gives rise to many new phenomena, such as the dependence of the equilibrium interfacial concentrations on the magnitude of the supersaturation in the parent phase, the misfit between the precipitate and matrix and the difference in the partial molar volumes of the diffusing species. Capillarity is also strongly influenced by the crystallinity through the surface stress and deformation, supersaturation of the parent phase, and the degree of elastic inhomogeneity. It is concluded that approximating the equilibrium interfacial conditions during phase transformations in solids using thermodynamics which is valid only for fluids may be erroneous in many cases.

800,328

PB88-192299

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.

Ultra-Sensitive Laser Isotope Analysis of Krypton in an Ion Storage Ring.

Final rept.,
J. J. Snyder, T. B. Lucatorto, P. H. Debenham, R. E. Bonanno, and C. W. Clark. 1985, 2p
See also PB88-175492.
Pub. in *Proceedings of International Conference on Laser Spectroscopy* (7th), Maui, HI., June 24-28, 1985, p389-390.

Keywords: *Krypton isotopes, Laser spectroscopy, Ion storage.

No abstract available.

800,329

PB88-192331

PC A06
National Bureau of Standards, Gaithersburg, MD.

Journal of Research of the National Bureau of Standards, Volume 93, Number 2, March-April 1988.

1988, 102p
Also available from Supt. of Docs. as SN703-027-00021-1. See also PB88-192349 through PB88-192356, and PB88-169727.

Keywords: *Ideal gas law, *Constants, *Combustion, *Calorimeters, *Aromatic monocyclic hydrocarbons, *Alcohols, Fluid mechanics, Controllers, *Universal gas standard, *Hexadecane, Computer applications.

No abstract available.

800,330

PB88-192364

(Order as PB88-192331, PC A06)
Georgetown Univ., Washington, DC.

Partitioning of Alkylbenzenes and Aliphatic Alcohols between Hexadecane and Methanol-Water Mixtures.

M. Schantz, B. N. Barman, and D. E. Martire. 25 Nov 87, 13p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Pub. in *Jnl. of Research of the National Bureau of Standards*, v93 n2 p161-173 Mar-Apr 88.

Keywords: *Aromatic monocyclic hydrocarbons, *Alcohols, Mixtures, Carbinols, Water, Separation, Gas chromatography, Gas liquid chromatography, *Hexadecane.

Partition coefficients between n-hexadecane and methanol-water mixtures are reported and analyzed for a series of alkylbenzenes and aliphatic alcohols. A custom-designed flask which has a side arm attached near the bottom was used for the measurements. The

hexadecane layer was sampled from the top of the flask, and the aqueous layer was sampled through the side arm of the flask. Both phases were analyzed by an appropriate analytical technique, either gas or liquid chromatography, to determine concentrations.

800,331

PB88-193826

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Investigation of Interfaces in a Ni/Cr Multilayer Film with Secondary Ion Mass Spectrometry.

Final rept.,
M. Moens, F. C. Adams, D. S. Simons, and D. E. Newbury. 1986, 3p
Pub. in *Springer Ser. Chem. Phys.* 44, p377-379 1986.

Keywords: *Interfaces, Laminates, Nickel, Chromium, Metal films, Thin films, Ion irradiation, Surfaces, Depth, Reprints, Secondary ion mass spectroscopy, Standard reference materials.

Surface and depth studies of several different metal interface systems have indicated the potential seriousness of possible profile distortion phenomena. The NBS Ni/Cr multilayers thin film Standard Reference Material (SRM 2135) can be effectively used to study these phenomena and to optimize sputtering conditions so as to achieve maximum interface resolution. The system has been studied using oxygen, argon and cesium ion bombardment. Best interfacial resolution could be obtained by using low impact energies, high angles of incidence, oxygen bleeding of the sample, and high mass primary ions. Secondary ion yield variations have been observed, especially at interfaces.

800,332

PB88-193941

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Single Pulse Shock Tube Studies on the Stability of Aromatic Compounds.

Final rept.,
W. Tsang, and D. Robaugh. 1985, 8p
Pub. in *Proceedings of International Symposium on Shock Waves and Shock Tubes* (15th), Berkeley, CA., July 28-August 2, 1985, p319-326.

Keywords: *Ethyl benzene, *Nitrobenzenes, *Aromatic compounds, Shock tubes, Reaction kinetics, Chemical bonds, *Isopropyl benzene, *Phenyl iodide.

Ethylbenzene, isopropylbenzene, phenyl iodide and nitrobenzene have been decomposed in single pulse shock tube experiments. Mechanisms and rates of the initial decomposition step have been determined. For the alkylbenzene compounds the initial reaction is in all cases the breaking of the benzylic C-C bond as opposed to the recent suggestion that benzylic C-H bond cleavage is the predominant process. In nitrobenzene decomposition the two important processes are C-NO₂ bond break and an isomerization process to form the nitrite followed by rapid cleavage of the O-NO bond.

800,333

PB88-193958

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Shock-Tube Pyrolysis of Acetylene: Sensitivity Analysis of the Reaction Mechanism for Soot Formation.

Final rept.,
M. Frenklach, D. W. Clary, W. C. Gardiner, and S. E. Stein. 1986, 7p
Pub. in *Proceedings of the International Symposium on Shock Waves and Shock Tubes* (15th), Berkeley, CA., July 28-August 2, 1985, p295-301 1986.

Keywords: *Acetylene, *Soot, Shock tubes, Pyrolysis, Reaction kinetics, Shock waves, Gases, High temperature tests, Thermochemistry.

The effects of variation in the thermochemical data on model prediction of soot yields in shock-tube pyrolysis of acetylene and on the dominate reaction pathway to soot identified in a previous study are investigated. The computational results demonstrate that the accuracy of thermodynamic data is as important as that of rate coefficients in modeling of high-temperature kinetics.

800,334

PB88-193966

Not available NTIS

Physical & Theoretical Chemistry

National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Droplet Size Measurements in a Swirling Kerosene Spray Flame by Laser Light Scattering.

Final rept.,
 C. Presser, A. K. Gupta, R. J. Santoro, and H. G. Semerjian. 1985, 13p
 Pub. in Proceedings of International Conference on Liquid Atomisation and Spray Systems (3rd), London, England, July 8-10, 1985, v2 pVII.C.2.1-VII.C.2.13.

Keywords: *Flame spraying, *Atomizing, *Spraying, Kerosene, Drops(Liquids), Swirling.

An ensemble light scattering technique has been employed to determine local fuel droplet characteristics in dense sprays and spray flames. Spatial distributions of mean droplets size and number density are presented for a pressure atomized kerosene spray introduced into a swirling air flow field. The measurements are complemented with Lorenz-Mie calculations of the scattering characteristics of a polydispersion of droplets. The sensitivity of the scattering characteristics to refractive index is used to discriminate between absorbing and nonabsorbing particles in a burning spray.

800,335
PB88-194303 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Techniques for Studying Autoionization in Isoelectronic and Isonuclear Sequences.

Final rept.,
 T. J. McIlrath, and T. B. Lucatorto. 1985, 20p
 Pub. in Proceedings of Workshop on Some Aspects of Autoionization in Atoms and Small Molecules, Argonne, IL, May 2, 1985, p55-74.

Keywords: Atomic structure, Far ultraviolet radiation, *Autoionization, Isoelectronic sequence, Laser radiation.

No abstract available.

800,336
PB88-194865 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Critical Assessment of Atomic Spectroscopy Data.

Final rept.,
 W. L. Wiese. 1987, 8p
 Pub. in Report of Workshop on the Assessment of Atomic Data, St. Catherine's College, Oxford, England, August 1-2, 1987, p76-83.

Keywords: *Atomic spectroscopy, Transition probabilities, Oscillator strengths, US NBS.

The activities of the atomic spectroscopy data center at NBS are summarized, and the principal activity-the production of comprehensive tables of critically evaluated data-is discussed in some detail for the case of atomic transition probabilities. The critical factors entering into the main experimental and theoretical methods for the determination of these atomic quantities are reviewed, and some sample cases from the NBS data center work are presented. Comparison tables and figures illustrate the problems encountered in the critical assessment process.

800,337
PB88-194923 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Studies of Electric Field Effects on Barium Autoionizing Resonances.

Final rept.,
 E. B. Saloman, J. W. Cooper, and D. E. Kelleher. 1985, 12p
 Pub. in Atomic Excitation and Recombination in External Fields, p325-336 1985.

Keywords: *Barium, Electric fields, Stark effect, *Autoionization, Laser radiation.

Field mixing of barium autoionizing resonances has been investigated in the spectral range from 42700/cm to 44300/cm using two-step and three-step laser ionization to excite respectively resonances of even and odd parity. With applied fields, the spectra obtained via either excitation scheme become quite complex since broad resonances of odd parity mix with much narrower resonances of even parity. Examples of destructive interference and of asymmetric line profiles due to field mixing are given.

800,338
PB88-195003 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD.

Multiphoton Ionization Detection of CH, Carbon Atoms, and O₂ in Premixed Hydrocarbon Flames.
 Final rept.,
 P. J. H. Tjossem, and K. C. Smyth. 1988, 7p
 Pub. in Chemical Physics Letters 144, n1 p51-57, 12 Feb 88.

Keywords: *Atomic energy levels, Vibrational spectra, Molecular structure, Reprints, *Multiphoton ionization.

Measurements of the multiphoton ionization (MPI) spectra of CH, C atoms, and O₂ have been made in atmospheric-pressure CH₄/air and C₂H₄/air flames in the 280-315 nm region. The transitions involved are D (sup 2 Pi sub J) <- <- x (sup 2 Pi sub r) and E prime (sup 2 sigma (1+)) <- <- X (sup 2 Pi sub r) for CH, the triplet (D sub J) <- <- triplet (P sub J) and singlet S(0) <- <- singlet D(2) multiplets for carbon atoms, and (3s sigma) (sup 3 Pi sub g) <- <- x (sup 3 sigma (1-)) (sub g) for O₂. Unusual rotational line intensities are observed in the CH spectra, which double resonance experiments show arise from near resonance with the intermediate C (sup 2 sigma (1+)) state. The MPI spectrum of O₂ is much more intense in flames compared to room-temperature, atmospheric-pressure conditions.

800,339
PB88-195052 Not available NTIS
 National Bureau of Standards (NML), Washington, DC. Molecular Spectroscopy Div.
Structure and Vibrational Dynamics of the CO₂ Dimer from the Sub-Doppler Infrared Spectrum of the 2.7 micrometer Fermi Diad.

Final rept.,
 K. W. Jucks, Z. S. Huang, R. E. Miller, G. T. Fraser, and A. S. Pine. 1988, 11p
 Pub. in Jnl. of Chemical Physics 88, n4 p2185-2195, 15 Feb 88.

Keywords: *Infrared spectra, Carbon dioxide lasers, Infrared spectrometers, Fermi surfaces, Reprints, *Dimers.

Sub-Doppler infrared spectra of two Fermi resonance coupled bands of carbon dioxide dimer have been obtained at 3611.5 and 3713.9/cm using an optothermal molecular beam color-center laser spectrometer.

800,340
PB88-195094 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Network Structure in Epoxies. 5. Deformation Mechanism in Epoxies.

Final rept.,
 W. L. Wu, and B. J. Bauer. Feb 88, 8p
 See also PB86-193745.
 Pub. in Macromolecules 21, n2 p457-464 Feb 88.

Keywords: *Epoxy resins, *Molecular structure, *Neutron scattering, Thermosets, Unfolding, Reprints.

Small-angle neutron scattering (SANS) was used to investigate the response of network molecules to large strain deformation. Partially deuterated diglycidyl ether of bisphenol A (DGEBA) was cured with either tri- or diamines of different molecular weights. The change of the average distance between cross-links along the epoxy and the amine linkages can easily be detected from the shift in the positions of the scattering maxima. It was found that the average distance between cross-links remained almost unchanged along both the amine and the epoxy linkages as the bulk material underwent a large deformation. The above results are discussed and compared to the results from swollen networks that do show a substantial increase in average distance between cross-links.

800,341
PB88-195136 Not available NTIS
 National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Laser Probing of Gallium Spin Orbit State Desorption and Scattering from Silicon (100) Surfaces.
 Final rept.,
 K. L. Carleton, and S. R. Leone. 1987, 6p
 Grant NSF-PHY86-04504
 Sponsored by National Science Foundation, Washington, DC.

Pub. in Proceedings of Industry-University Advanced Materials Conference, Denver, CO., February 26-28, 1987, p9-14.

Keywords: *Gallium, *Silicon, *Desorption, Spin orbit interactions, Surfaces, Excitation, Laser induced fluorescence.

The interactions of individual gallium spin orbit states with silicon (100) surfaces were studied by laser probing. Laser induced fluorescence was used.

800,342
PB88-196829 Not available NTIS
 National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Tunable Far Infrared Laser Spectroscopy.

Final rept.,
 K. M. Evenson, D. A. Jennings, L. R. Zink, and K. R. Leopold. 1986, 5p
 Contract NASA-W-15047
 See also PB88-153945. Sponsored by National Aeronautics and Space Administration, Washington, DC., and Chemical Manufacturers Association, Washington, DC.
 Pub. in Proceedings of International Conference on Infrared and Millimeter Waves (11th), Pisa, Italy, October 20-24, 1986, p267-271.

Keywords: *Infrared spectroscopy, Far infrared radiation, *Laser spectroscopy, High resolution, Tunable lasers.

The paper is an abstract of the invited lecture to be presented at the Pisa meeting. The talk summarizes the authors' work in tunable far infrared laser spectroscopy.

800,343
PB88-197983 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Surface Electronic Structure and Chemisorption on Corundum Transition-Metal Oxides: alpha-Fe₂O₃.
 Final rept.,
 R. L. Kurtz, and V. E. Henrich. 1987, 9p
 Grant NSF-DMR82-02727
 Sponsored by National Science Foundation, Washington, DC.
 Pub. in Physical Review B 36, n6 p3413-3421, 15 Aug 87.

Keywords: *Iron oxides, *Chemisorption, *Surfaces, Ultraviolet spectroscopy, Oxygen, Water, Hydrogen, Sulfur dioxide, Reprints, *Electronic structure, Photoemission.

Ultraviolet photoemission spectroscopy has been used to study the electronic structure of both nearly stoichiometric, well-ordered alpha-Fe₂O₃ surfaces and surfaces containing point defects. The interaction of O₂, H₂O, H₂, and SO₂ with both types of surfaces has also been investigated.

800,344
PB88-197991 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Wavelengths and Energy Levels of I V and I VI.

Final rept.,
 V. Kaufman, J. Sugar, and Y. N. Joshi. 1988, 4p
 Sponsored by Department of Energy, Washington, DC. Div. of Magnetic Fusion Energy, and Natural Sciences and Engineering Research Council of Canada, Ottawa (Ontario).
 Pub. in Jnl. of the Optical Society of America B 5, n3 p619-622 Mar 88.

Keywords: *Iodine, *Ultraviolet spectra, Atomic energy levels, Ionization, Far ultraviolet radiation, Wavelengths, Reprints, Soft x radiation.

The spectra of iodine were photographed in the 139-1500-A region on various spectrographs. Earlier analyses of I v and I vi were revised and extended. For I v, 26 lines were classified, and for I vi, 35 lines were classified. Ionization energies have been estimated.

800,345
PB88-198858 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

CHEMISTRY

Physical & Theoretical Chemistry

Half and Full Collision Matrix Methods for Scattering: Application to Multichannel Curve Crossing.

Final rept.,
Y. B. Band, and F. H. Mies. 1988, 11p
Sponsored by Air Force Office of Scientific Research,
Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 88, n4 p2309-2319, 15
Feb 88.

Keywords: Schrodinger equation, Energy transfer,
Transition probabilities, Scattering, Reprints, *Atom-
atom collisions, Vibrational states, Random phase ap-
proximation, WKB approximation.

The authors present methods of numerically solving
the multichannel Schrodinger equation by propagating
exact first-order coupled equations for a specially de-
signed half collision matrix $X(r)$. In particular, they
define a classical half collision matrix $Z(r)$ by neglect-
ing rapidly oscillating terms in the propagation of $X(r)$.
The various methods are demonstrated by applying
them to a multichannel curve crossing in atom-diatom
vibrational energy transfer collisions.

800,346

PB88-198874 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD. Reactor Radiation Div.

Elastic Neutron Scattering Studies of the Structure of Graphite Intercalated with Potassium and Ammonia.

Final rept.,
Y. B. Fan, S. A. Solin, D. A. Neumann, H. Zabel, and
J. J. Rush. 1987, 8p
Grants NSF-DMR86-05565, NSF-DMR85-17223
Sponsored by National Science Foundation, Washing-
ton, DC.
Pub. in Physical Review B 36, n6 p3386-3393, 15 Aug
87.

Keywords: Graphite, Potassium, Ammonia, Stratifica-
tion, Diffraction, Models, Neutron scattering, Elastic
scattering, Clustering, Molecular structure, Reprints,
Computer applications.

Measured were the in-plane and c-axis elastic neutron
scattering from the ternary potassium-ammonia-graphite
intercalation compound $K(ND_3)_{0.4}C_{24}$ at room
temperature. The c-axis scans establish that the
graphite layers stack in an eclipsed configuration and
that there is no correlation between the intercalant
layers. The in-plane diffuse scattering from the intercalant
layers is well accounted for by a computer-generated
structural model in which each potassium ion is
symmetrically four-fold coordinated to ammonia mole-
cules to form closely packed, five-membered clusters.
This model had been previously applied to explain the
in-plane diffuse x-ray scattering results from
 $K(HN_3)_{0.4}C_{24}$. Discrepancies between the calculated
and measured diffraction patterns are attributed to
a relaxation of the four-fold symmetry of the $K-ND_3$
clusters.

800,347

PB88-198957 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Chemical Kinetics Div.

V->R, T Energy Transfer Processes in Vibrationally Excited Pentafluorobenzene Using a Hg Tracer Absorption Method.

Final rept.,
T. J. Wallington, M. D. Scheer, and W. Braun. 1987,
5p
Pub. in Chemical Physics Letters 138, n6 p538-542, 7
Aug 87.

Keywords: *Energy transfer, Absorption, Carbon diox-
ide lasers, Reprints, *Cyclohexane/pentafluoro, Vibra-
tional states, Excited states.

A new technique based upon the Doppler and Lorentz
broadening of the isotopic and hyperfine Hg multiplet
lines near 254 nm was used to monitor the transla-
tional equilibration of vibrationally excited pentafluoro-
benzene (PFB). Excitation was achieved with a pulsed
CO₂ infrared laser focused into a cell containing PFB
and a trace amount of Hg. Rates of V->R, T energy
transfer were found to be linearly dependent on both
the excitation energy and the pressure of PFB. Excita-
tion energies were independently determined by the
Hg absorption technique and by measuring the change
in absorption by the PFB at 254 nm.

800,348

PB88-199039 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Inorganic Analytical Research Div.

Cross-Square Rule for Transport in Electrolyte Mixtures.

Final rept.,
Y. C. Wu, W. F. Koch, E. C. Zhong, and H. L.
Friedman. 1988, 4p
Pub. in Jnl. of Physical Chemistry 92, n6 p1692-1695
1988.

Keywords: *Electrolytes, Mixtures, Conductivity, Elec-
trical resistivity, Reprints, Ionic conductivity.

Experimental data for three mixed electrolytes of dif-
ferent charge types show that Young's cross-square
rule, previously established for thermodynamic coeffi-
cients, applies quite accurately to the electrical con-
ductivities of these systems. Model calculations,
based on an integral equation theory of ionic transport
in solutions, show qualitatively similar behavior. The
simplest models (essentially charged soft spheres in a
dielectric, viscous continuum) show more regular
mixing effects than those found experimentally, but
modifying these potentials to make them more realistic
also results in more realistic mixing coefficients. It is
suggested that these observations may form the basis
of an empirical scheme for predicting ionic transport in
electrolyte mixtures on the basis of data for single
electrolytes and their common-ion mixtures.

800,349

PB88-199047 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Time and Frequency Div.

Spectroscopic Observation of the CH Radical in Its a(4)Sigma(-1) State.

Final rept.,
T. Nelis, J. M. Brown, and K. M. Evenson. 1988, 2p
Contract NASA-W-15047
Sponsored by National Aeronautics and Space Admin-
istration, Washington, DC.
Pub. in Jnl. of Chemical Physics 88, n3 p2087-2088, 1
Feb 88.

Keywords: *Infrared spectra, *Laser spectroscopy,
Metastable state, *Hydrocarbon radicals.

Reported is the first spectroscopic observation of CH
in the $a_4 \sigma(-1)$ state. Spin components of the first
two rotational transitions have been detected in the far
infrared by laser magnetic resonance. The molecule
was generated in a discharge-flow system in the reac-
tion between fluorine atoms and methane (with a trace
of oxygen added) or between oxygen atoms and acet-
ylene at a total pressure of about 1 torr.

800,350

PB88-200290 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Ultraviolet Absorption Determination of Intramolecular Predissociation Dynamics in (CH3)2 and (CD3)2.

Final rept.,
D. J. Donaldson, V. Vaida, and R. Naaman. 1988, 5p
Sponsored by National Science Foundation, Washing-
ton, DC.
Pub. in Jnl. of Physical Chemistry 92, n5 p1204-1208
1988.

Keywords: *Ultraviolet spectra, Deuterium com-
pounds, Adsorption, Reprints, *Methyl iodide, *Deuter-
ated methyl iodide, *Predissociation, Rydberg states.

The paper reports the ultraviolet absorption spectra of
jet-cooled CH₃I and CD₃I in the Rydberg B and C
states. The monomer spectrum of each consists of a
single, short progression in the $\mu(\text{sub } 2)$ (CH₃ um-
brella) mode. Dimer formation results in significant
changes in the relative intensities of the members of
this progression as well as the appearance of 'new'
spectral features. These features are associated with
the vibrational modes of methyl iodide which are most
strongly coupled to the predissociative surface cross-
ing. From these measurements the authors develop a
model for the effect of dimerization on the predissocia-
tion and quantify the energy and shape of the surface
crossing.

800,351

PB88-200308 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD. Reactor Radiation Div.

Applications of Fixed Wavelength Neutron Powder Diffraction.

Final rept.,
E. Prince. 1987, 10p
Pub. in Transactions of the American Crystallographic
Association 23, p51-60 1987.

Keywords: *Neutron diffraction, Ion exchange resins,
Reprints, Ionic conductivity, Rietveld method, Zeolites.

A summary of the Rietveld method of structure refine-
ment, as applied to neutron powder diffraction data, is
given. Applications of the method to studies of ionic
conductors of the NASICON system, of lithium inser-
tion compounds of the composition $\text{Li}(x)\text{ReO}_3$, and of
framework configurations and extra-framework ions
and molecules in zeolites rho, A and Y are reviewed.

800,352

PB88-200324 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Surface Science Div.

Isotope Dilution Neutron Spectroscopy: A Vibrational Probe of Hydrogen/Deuterium Adsorbate Interactions on Palladium Black.

Final rept.,
J. M. Nicol, T. J. Udovic, J. J. Rush, and R. D. Kelley.
1988, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Langmuir 4, n2 p294-297 1988.

Keywords: *Neutron scattering, *Hydrogen, *Deuteri-
um, Inelastic scattering, Vibrational spectra, Surface
chemistry, Adsorption, Reprints, *Isotope dilution, Pal-
ladium black.

Incoherent inelastic neutron scattering has been used
to probe the vibrational spectra of both pure H and
dilute H in D on Pd black. The occupation of both sur-
face and subsurface sites at submonolayer coverage
for pure H and the preferential H occupation of subsur-
face sites for dilute H in D are observed. For the pure H
surface phase, considerable width and structure in the
vibrational density of states for the degenerate parallel
stretching modes reflect significant phonon dispersion,
indicating the presence of strong H-H interactions. Iso-
tope dilution of H with D replaces this dispersion with a
narrower local mode feature shifted higher in energy.
Comparison with simple mass-defect theory suggests
the presence of some anharmonicity in the Pd-H bond-
ing potentials for the surface H phase.

800,353

PB88-201603 PC A04/MF A01
National Bureau of Standards (NML), Gaithersburg,
MD. Chemical Thermodynamics Div.

Thermodynamic Properties of Halides, Hydrides, and Deuterides of Cobalt, Iron, and Nickel. 1. Literature Citations.

Technical note (Final),
C. R. Jackson, and M. W. Chase. Dec 87, 53p NBS/
TN-1244
Also available from Supt. of Docs.

Keywords: *Thermodynamic properties, *Bibliogra-
phies, *Halides, *Hydrides, *Deuterides, Heat of for-
mation, Electron affinity, Electronic energy levels,
Thermochemistry, Cobalt, Iron, Nickel.

A bibliographic collection is provided on data which are
necessary for the calculation of the thermochemical
properties of the gaseous metal halides, hydrides
(deuterides) and their positive and negative ions (MX,
MX⁺ and MX⁻), where M = Co, Fe, and Ni and X =
Br, Cl, F, H(D), and I. This is the first in a series of
articles that will document the information used in the
critical evaluation of the thermodynamic properties of
these substances for the JANAF Thermochemical
Tables. The collection contains references which have
been published through the end of 1986 with some
1987 references. Fifteen bibliographies are given, one
for each species. In all bibliographies, the references
are listed chronologically; alphabetically by first author
within each year. The names of the species are given
according to the Chemical Abstracts system of nomen-
clature (as of the Tenth Collective Index) when
possible. The Chemical Abstracts Registry Numbers, if
assigned, are also given for each of the species. A
brief summary of the type of available information is
given.

800,354

PB88-204383 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Center for Basic Standards.

Polarization of Molecular X-ray Fluorescence.

Final rept.,
D. W. Lindle, P. L. Cowan, R. E. LaVilla, T. Jach, R. D. Deslattes, B. Karlin, J. A. Sheehy, T. J. Gil, and P. W. Langhoff. 1988, 4p
Grant NSF-CHE86-14344
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review Letters 60, n11 p1010-1013, 14 Mar 88.

Keywords: *X ray fluorescence, Chloromethanes, Polarization, Synchrotron radiation, Reprints, *Methylene chloride.

Polarization of Cl K beta x-ray fluorescence following selective excitation of gaseous CH₃Cl with synchrotron radiation is reported. The degree of polarization of the fluorescence depends sensitively on the chosen incident excitation energy in the Cl K-edge region. Theoretical considerations indicate that the fluorescence-polarization measurements can provide directly absorption and emission anisotropies, molecular-orbital symmetries, and relative fluorescence transition strengths.

800,355
PB88-204391

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Nuclear Spin Statistical Weights for the Trimers and Tetramers of C₂H₂, C₂H₂D, and CO₂.

Final rept.,
A. Weber. 1988, 6p
Pub. in Jnl. of Chemical Physics 88, n6 p3428-3433, 15 Mar 88.

Keywords: *Molecular spectroscopy, *Acetylene, *Carbon dioxide, Reprints, Deuterated acetylene, Trimers, Tetramers.

Nuclear spin statistical weights have been calculated for the rotational levels of C₂H₂ trimers and tetramers for various geometries having D(3h), C(3h), D(4h), and D(2d) symmetries as well as for the several possible planar trimer and tetramer forms of C₂H₂D to assist in the interpretation of high resolution rotation-vibration spectra of these complexes. Results are also given for the trimers and tetramers of CO₂. The weights obtained for the (12)C₂H₂ trimer with C(3h) symmetry as well as the weights for the trimers of (12)C₂H₂D are directly applicable to the trimers of HF and H (12)CN, respectively. Reference is made to earlier calculations of the nuclear spin statistical weights for monomer molecules, the results of which may sometimes be transferred to van der Waals and hydrogen-bonded complexes. A discussion is presented on the role of the separable degeneracies occurring in the classification of energy levels of molecules belonging to one of the C(nh) or other point groups with complex characters.

800,356
PB88-204508

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Spectral Data and Grottrian Diagrams for Highly Ionized Titanium, Ti V-Ti XXII.

Final rept.,
K. Mori, W. L. Wiese, T. Shirai, Y. Nakai, K. Ozawa, and T. Kato. 1986, 106p
Pub. in Atomic Data and Nuclear Data Tables 34, n1 p79-184 Jan 86.

Keywords: Atomic energy levels, Wavelengths, Transition probabilities, Spectra, Reprints, *Titanium ions, Oscillator strengths, Grottrian diagrams.

Wavelengths, energy levels, level configurations, oscillator strengths, and radiative transition probabilities for the titanium ions Ti V to Ti XXII are critically reviewed and tabulated. Grottrian diagrams are also presented to provide a graphical overview.

800,357
PB88-204540

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Wavelength and Lifetime Measurements on Intercombination Transitions in 12- to 14-Electron Ions of Zn.

Final rept.,
E. Trabert, P. H. Heckmann, and W. L. Wiese. 1988, 2p
Pub. in Zeitschrift fuer Physik D: Atoms, Molecules and Clusters 8, p209-210 1988.

Keywords: *Zinc, *Electron transitions, Transition metals, Reprints.

The VUV spectrum of foil-excited fast Zn ions has been studied in search for the intercombination transitions in Mg I-, Al I- and Si I-like ions. The line identifications are supported by decay curve measurements. The wavelength and lifetime data are compared with available theoretical predictions.

800,358
PB88-204862

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

ESDIAD (Electron-Stimulated Desorption Ion Angular Distributions) of First-Row Protic Hydrides Adsorbed on Si(100): Structure and Reactivity.

Final rept.,
A. L. Johnson, M. M. Walczak, and T. E. Madey. 1988, 6p
Sponsored by Department of Energy, Washington, DC.
Pub. in Langmuir 4, n2 p277-282 1988.

Keywords: *Silicon, *Chemisorption, Surface chemistry, Water, Ammonia, Hydrogen fluorides, Chemical reactivity, Reprints, ESDIAD method.

The interaction of the first-row protic hydrides (H₂O, NH₃, and HF) with silicon is of scientific interest in the investigation of bonding of small molecules to semiconductor surfaces and of technological interest due to their importance in device processing. These chemisorption systems on stepped Si(100) have been investigated by using ESDIAD (electron-stimulated desorption ion angular distributions) and other surface-sensitive techniques. The paper relates the results to the chemisorption geometry and the state of hydrogen in these adsorbates and suggest trends in the modes of chemisorption. Reversible temperature-dependent azimuthal ordering of the ESDIAD patterns has been found in some cases; implications in terms of lateral surface interactions and the mode of chemisorption of these molecules are discussed.

800,359
PB88-204938

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Measurement of Collisional V -> T,R Energy Transfer in Vibrationally Excited SF₆ Using Doppler Broadening of the Hg(6) singlet S(0) - 6 triplet P(1) Multiplet.

Final rept.,
W. Braun, M. D. Scheer, and R. J. Cvetanovic. 1988, 7p
Pub. in Jnl. of Chemical Physics 88, n6 p3715-3721, 15 Mar 88.

Keywords: *Sulfur hexafluoride, Molecular relaxation, Excitation, Particle collisions, Reprints, *Multiphoton absorption.

A new method for measuring energy transfer between colliding molecules has been developed. It is based upon the temperature dependence of the isotopic and hyperfine line widths of the Hg multiplet in the neighborhood of 254 nm. The light source was a Hg resonance lamp whose line profiles could be precisely controlled by varying the Hg pressure. Multiphoton absorption at 944/cm was used to excite SF₆ vibrationally during a 250 ns CO₂ laser pulse. The subsequent rate of equipartition of the excess vibrational energy with the translational and rotational degrees of freedom was determined by measuring the initial slope of the increase in the absorption of 254 nm radiation by a trace of Hg vapor. It was found that pressures above 2 Torr were required to involve all of the SF₆ molecules in the absorption of the laser radiation. The V -> T, R energy transferred per SF₆-SF₆ collision was found to be proportional to the 3/2 power of the excitation energy between 1500 and 5000/cm and gradually changed to a first power dependence in the 300 to 1000/cm range.

800,360
PB88-204946

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Gas Phase Reactions of Hydroxyl Radicals with a Series of Carboxylic Acids over the Temperature Range 240-440 K.

Final rept.,
P. Dagaut, T. J. Wallington, R. Liu, and M. J. Kurylo. 1988, 8p
Contract NASA-W-15816
See also PB88-177597. Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in International Jnl. of Chemical Kinetics 20, p331-338 1988.

Keywords: *Chemical reactivity, Chemical radicals, Reaction kinetics, Carboxylic acids, Reprints, *Hydroxyl radicals.

The temperature dependencies of the rate constants for the gas phase reactions of OH radicals with a series of carboxylic acids were measured in a flash photolysis resonance fluorescence apparatus over the temperature range 240-440 K. The data at total pressures (using Ar diluent gas) between 25-50 torr for acetic acid (k sub 1), propionic acid (k sub 2), and i-butyric acid (k sub 3) were used to derive the Arrhenius expressions. At 298 K, the measured rate constants (in units of 10 to the -12th power cc/molecule s) were: k sub 1 = (0.74 + or - 0.06), k sub 2 = (1.22 + or - 0.12), and k sub 3 = (2.00 + or - 0.20). In addition a rate constant of (0.37 + or - 0.04), in the above units, was determined for the reaction of OH with formic acid. The error limits cited above are 2 sigma from the linear least squares analyses. These results are discussed in terms of the mechanisms for these reactions and are compared to literature data.

800,361
PB88-209473

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Thermal Expansion of a Structure II Hydrate Using Constant Pressure Molecular Dynamics.

Final rept.,
M. Marchi, and R. D. Mountain. 1 Jan 87, 2p
Contract DE-AI21-84MC21089
Supersedes PB87-218970. Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 86, n11 p6454-6455, 1 Jun 87.

Keywords: *Thermal expansion, Thermal stability, Reprints, *Clathrate, *Molecular dynamics, Hydrates.

Constant pressure molecular dynamics simulations were used to investigate the thermal stability of a structure II clathrate crystal containing krypton guest atoms relative to the empty hydrate. The temperature ranged from 70 to 280 K and the hydrate remained stable over this interval. The empty hydrate spontaneously transformed to an amorphous ice structure at about 240 K.

800,362

PB88-209515

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Hydrogen Migration Tunneling Effects in the Rotational and Vibrational Spectrum of Protonated Acetylene C₂H₃(1+).

Final rept.,
J. T. Hougen. 1987, 31p
Supersedes PB87-218988.
Pub. in Jnl. of Molecular Spectroscopy 123, No. 1, p197-227 1987.

Keywords: Reprints, *Hydrogen tunneling, Hydrogen migration, Vibration rotation spectra, Ion spectra, Large amplitude motion, *Acetylene, High resolution.

The influence of a possible hydrogen atom migration in protonated acetylene, C₂H₃(+) on the high-resolution vibration-rotation spectrum of the ion is considered. The migration model, which derives from ab initio calculations, consists of a planar structure with the three hydrogen atoms moving on an approximately elliptical path around the two carbon atoms. Symmetry considerations for this ion are discussed in terms of the permutation-inversion group G(24). A method for calculating energy levels for a highly idealized model of this ion can be found in the early microwave literature. In this idealized model, an equilateral triangle of three hydrogen atoms performs internal rotation about a dumbbell of two carbon atoms, with all atoms remaining in the same plane. The model gives rise to a symmetric rotor top, an asymmetric rotor frame, and a sixfold barrier to the internal rotation motion. An alternative method of calculating the migrational tunneling splittings in the ion, involving a more recently proposed algebraic formalism, shows that qualitatively similar splitting patterns are obtained even when the hydrogens are not constrained to form a rigid equilateral triangle during their migration motion. Energy level diagrams, nuclear spin statistical weights, selection rules for electric dipole transitions, etc., are presented. It is hoped that the patterns described in the present work will aid in identifying

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ing and interpreting any spectrum of C₂H₃(-) obtained as a result of ongoing efforts elsewhere in high-resolution ion spectroscopy.

800,363
PB88-209556 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Microwave Spectra of the (HF)₂ (DF)₂, HFDF, and DFHF Hydrogen-Bonded Complexes.
Final rept.,
W. J. Lafferty, R. D. Suenram, and F. J. Lovas. 1987, 19p
Supersedes PB87-218996.
Pub. in Jnl. of Molecular Spectroscopy 123, No. 2, p434-452 1987.

Keywords: Reprints, *Dimers, *Hydrofluoric acid, Hydrogen bonded complexes, Microwave spectrum, Tunneling rotation spectrum.

The microwave spectra of the tunneling-rotation bands of the hydrogen-bonded complexes (HF)₂ and (DF)₂ have been measured in the 50- to 126-GHz region. In addition, the pure rotation spectra of both the HFDF and DFHF molecules have been obtained. Transitions with $K = 0$ through $K = 2$ have been observed for all isotopic species. The hydrogen fluoride dimer is a very nonrigid molecular species. In order to fit the observed transitions adequately, empirical expressions for the energy levels were used, and each K subband was separately fitted. Constants obtained from a Pade approximant fitting of the microwave data of (HF)₂ together with infrared ground state combination differences are given.

800,364
PB88-209572 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Effects of Very Low Electric Fields on Narrow Autoionizing States in Gadolinium.
Final rept.,
V. I. Mishin, G. Lombardi, D. E. Kelleher, and J. W. Cooper. 1987, 4p
Supersedes PB87-218939.
Pub. in Physical Review A-General Physics 35, n2 p664-667 1987.

Keywords: Reprints, *Rare earth spectra, Rydberg states, Stark effect, *Gadolinium.

The effects of electric fields on two autoionizing states, one of odd and one of even parity, with long life-times lying approximately 230 cm⁻¹ above the ionization limit has been studied in detail by multi-step laser ionization. The spectral lines corresponding to these states broaden slightly with the application of extremely weak fields. The line width dependence with field for both lines has been measured for fields up to 6 V/cm. For one of the lines the measurements have been extended to higher field strengths. It is found that most of the broadening occurs in the weak field region, but that some additional broadening occurs at higher field strengths. The weak field broadening is attributed to configuration mixing of the autoionizing states with the Rydberg states of high principal quantum number. This lends sufficient high Rydberg character to the observed state to make them extremely sensitive to fields.

800,365
PB88-209598 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Rotational, Structural, ab Initio and Semirigid Bender Analysis of the Millimeter Wave Spectrum of H₂CO-HF.
Final rept.,
F. J. Lovas, R. D. Suenram, S. Ross, and M. Klobukowski. 1987, 20p
Supersedes PB87-219002.
Pub. in Jnl. of Molecular Spectroscopy 123, n1 p167-186 1987.

Keywords: Reprints, *Ab initio calculations, *Centrifugal distortion, Dimers, Rotational spectrum, *Semirigid bender.

The hydrogen-bonded species H₂CO-HF has been studied in a conventional microwave absorption cell. The dimer was produced under equilibrium conditions at -78C from a mixture of H₂CO and HF. Spectra from H₂CO-HF, H₂CO-DF, and D₂CO-DF are reported. Rotational spectra from two low-energy excited vibrational states, which involve the hydrogen bond, have been

observed. Structural analysis was performed by fitting rotational constants after correcting the observed rotational constants for contributions from the low-energy vibrational states. The semirigid bender model was fitted to the observed rotational structure of the bending vibrational levels. The bending potential function and the intermolecular distance were determined in the fittings. SCF ab initio calculations were used to model the bending vibrational dynamics and the potential functions of the three in-plane intermolecular vibrations.

800,366
PB88-209614 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Special Effects of an Unusually Large Neutral to Radical Cation Geometry Change / Adiabatic Ionization Energies and Proton Affinities of Alkylhydrazines.
Final rept.,
M. Mautner, S. F. Nelsen, M. F. Willi, and T. B. Frigo. 1984, 6p
Supersedes PB87-218947.
Pub. in Jnl. of the American Chemical Society 106, n24 p7384-7389 1984.

Keywords: Reprints, *Bond energies, *Hydrazines, Ionization energies, Molecular geometry, Proton affinities, Radical ions.

High pressure mass spectrometry was used to measure adiabatic ionization potentials and proton affinities for hydrazine, methylhydrazine, 1,1-dimethylhydrazine, and six tetraalkylhydrazines. Unusually large relaxation energies in the radical ions, with $v_{IP-aiP} = 1.2-1.6$ eV for most hydrazines vs. 0.7 eV in amines, reflect the stabilization of the planar R₂N-NR₂ ions by charge delocalization in the three electron bond. The proton affinities of hydrazines are lower by 4-6 kcal mol⁻¹ than of comparable amines, due to inductive effects of the adjacent nitrogens. The combined effects of lowered aiPs and lowered PAs decrease the B(+)H bond dissociation energies is protonated alkylhydrazines by ca. 20 kcal mol⁻¹ vs. comparable alkylamines.

800,367
PB88-217260 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Exchange Asymmetry in Elastic Scattering of Electrons by Sodium Atoms.
Final rept.,
D. H. Oza. 1988, 3p
Pub. in Physical Review A 37, n7 p2721-2723, 1 Apr 88.

Keywords: *Elastic scattering, Electrons, Excitation, *Sodium atoms, Exchange asymmetry.

Calculations of the exchange asymmetry in elastic scattering of electrons by sodium atoms are reported at incident electron energies of 10 and 54.4 eV. The close-coupling calculations are performed with the four lowest target states of the sodium atom. At 10 eV, the present calculations predict nearly pure singlet-state scattering and nearly pure triplet-state scattering at certain angles. At 54.4 eV, the theoretical results are compared with recent measurements. Qualitative agreement is obtained, although some discrepancy remains.

800,368
PB88-217294 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Concentration and Temperature Dependence of Hydrogen Vibrations Along the c Axis for Hydrogen in Yttrium: Evidence of Dynamically Coupled Hydrogen Pairs.
Final rept.,
I. S. Anderson, N. F. Berk, J. J. Rush, and T. Udovic. 1988, 5p
Pub. in Physical Review B 37, n9 p4358-4362, 15 Mar 88.

Keywords: *Hydrogen, *Yttrium, Vibrational spectra, Neutron spectroscopy, Reprints, *Temperature dependence.

The c-axis vibrations of hydrogen in yttrium have been measured at various concentrations and temperatures using high-resolution neutron spectroscopy. The unusual splitting of these modes is revealed to be highly sensitive to both conditions and to isotopic dilution. The results indicate that the splitting is caused by hy-

drogen pairs dynamically coupled across metal atoms and that this interaction is modulated by concentration- and temperature-dependent occupation correlations along the c-axis.

800,369
PB88-217419 PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Chemical Engineering.
Calculation of Critical Points by the Method of Heidemann and Khalil.
Technical note (Final),
B. E. Eaton. Mar 88, 53p NBS/TN-1313
Also available from Supt. of Docs. as SN003-003-2867-3

Keywords: *Critical point, Thermophysical properties, Computer applications.

The formulation of critical point criteria by Heidemann and Khalil is analyzed and contrasted with the original formulation of Gibbs. An extension to the solution technique originally used by Heidemann and Khalil, and later improved by Michelsen and Heidemann, is presented along with its detailed implementation for a general two-constant cubic equation of state. Finally, FORTRAN software developed for these computations is carefully documented.

800,370
PB88-217542 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Inelastic Neutron Scattering of the Interaction of Hydrogen with Palladium Black.
Final rept.,
J. M. Nicol, J. J. Rush, and R. D. Kelley. 1988, 14p
Pub. in Surface Science 197, p67-80 1988.

Keywords: *Neutron scattering, *Hydrogen, Vibrational spectra, Chemisorption, Adsorptivity, Powder metals, Reprints, Surface adsorption, Palladium black.

Incoherent inelastic neutron scattering has been used to investigate the interaction of hydrogen with palladium black (a high-surface-area Pd powder). Vibrational spectra of chemisorbed hydrogen have been measured in the energy range 30-230 meV at 80 and 295K. The dominant surface adsorption site of hydrogen has been identified by comparison of the vibrational frequencies and intensities provided by the scattering data with normal coordinate calculations for model structures of different geometries, force constants and bond lengths. The 'best fit' to the data is obtained for surface adsorption sites of threefold symmetry. A vibrational feature observed at 58 meV, which is inconsistent with either surface or bulk Pd-H species, is assigned to hydrogen occupying subsurface sites of bulk-like octahedral symmetry.

800,371
PB88-217831 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Variational Calculations for (4)He I: Improved Energies for singlet and triplet n D and n F Levels (n=3-8).
Final rept.,
J. S. Sims, and W. C. Martin. 1988, 11p
Pub. in Physical Review A 37, n7 p2259-2269, 1 Apr 88.

Keywords: *Atomic energy levels, *Atomic structure, *Ionization potentials, *Helium 4, Computation, Reprints, Vibrational states.

Hylleraas method variational calculations with up to 458 expansion terms are reported for the n singlet D n triplet D terms and for the n singlet F, n triplet F terms (n=4-8) of neutral helium. Convergence arguments are presented to obtain new estimates of the exact nonrelativistic energies of these terms. The reliability of the estimates ranges from 3X10 to the minus 10th power a.u. in the worst case to 10 to the minus 11th power a.u. in the best case. The nonrelativistic singlet and triplet energies are combined with previously calculated values for relativistic and other small energy contributions to evaluate the total ionization energies for the n D and n F levels. Comparisons of the n singlet D and n triplet D energies with other calculations and available data yield improved values for relativistic contributions. The calculated relativistic n F ionization energies agree with values based on core-polarization theoretical n G and n H energies within deviations of 3 MHz (5 X 10 to the minus 11th power a.u.) for n=5 to

1 MHz (1.5X10 to the minus 11th power a.u.) for $n=7.8$. The calculated n F fine structure separations generally agree with experiment for $n=5-8$ within uncertainties of the order of 1 to 0.1 MHz. Predicted values given for the 4F fine-structure separations and 4 singlet F ionization energy are probably accurate within a few MHz.

800,372
PB88-217856 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Chemical Modification of Pt Electrodes by Tetra (4-Pyridyl) Porphyrin through Siloxane Polymer Formation.
Final rept.,
C. A. Marrese, E. A. Blubaugh, and R. A. Durst.
1988, 9p
Pub. in Jnl. of Electroanalytical Chemistry 243, p193-201 1988.

Keywords: *Electrodes, *Organic coatings, *Porphyrins, Dip coating, Crosslinking, Reprints, Silane/bromopropyl-trimethoxy, Porphyrin/pyridyl, Sensors.

In an effort to develop electrocatalysts for liquid and gas electrochemical sensors, the title porphyrin was quaternized with 3-bromopropyltrimethoxysilane to form a reactive monomer that, under specific conditions, adheres to metal oxide and carbon surfaces. Films of the pyridyl porphyrin are formed on electrode surfaces by employing silane immobilization chemistry. The amount of porphyrin immobilized depends on the time of electrode immersion in the coating solution. The surface coverage and amount of silanol crosslinking determines the degree, or rate, of solute permeation; an example is given for ferrocene oxidation at an electrode modified with the porphyrin film at a surface coverages of 5×10 to the minus 9th power mol/sq-cm. The cobalt metallo porphyrin derivative also yields film formation, similar to the free base results, however, the current for the cobalt II/I couple disappears as the potential is cycled through the II/I couple.

800,373
PB88-217880 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Isotope Effects in the High-Resolution Infrared Spectrum of OC-HF.
Final rept.,
G. T. Fraser, and A. S. Pine. 1988, 6p
Pub. in Jnl. of Chemical Physics 88, n7 p4147-4152, 1 Apr 88.

Keywords: *Isotope effects, *Infrared spectra, Vibrational spectra, Molecular spectroscopy, Reprints.

High-resolution infrared spectra of the H-F stretching bands of natural OC-HF and enriched O(13)C-HF and (18)OC-HF have been recorded under thermal equilibrium conditions near 195 K with a tunable difference-frequency laser. The rotational constants of the three isotopic species are consistent with the linear C-H van der Waals bond as determined by microwave spectroscopy. The isotope shifts for the band centers exhibit a curious staggering with total CO mass which the authors attribute to anharmonic coupling of the zero-point CO bending motion. Resolved splittings of the I doublets in a hot band originating in the CO bending vibration yield tentative assignments and rotational constants for this low frequency van der Waals mode.

800,374
PB88-217898 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Vibrational Spectrum of the t-HOCO Free Radical Trapped in Solid Argon.
Final rept.,
M. E. Jacox. 1988, 10p
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in Jnl. of Chemical Physics 88, n8 p4598-4607, 15 Apr 88.

Keywords: *Vibrational spectra, *Argon, *Free radicals, Chemical radicals, Infrared spectra, Excitation, Formic acid, Molecular structure, Reprints.

When formic acid is codeposited at 14 K with a beam of excited argon atoms or of F atoms produced in a discharge, t-HOCO is produced in sufficient yield for the infrared detection of most of its vibrational fundamentals. The OH stretching, COH deformation, and torsion vibrations are considerably shifted from the po-

sitions previously reported for this species in a CO matrix, consistent with the stabilization of an OC HOCO hydrogen-bonded complex in the earlier experiments. A detailed normal coordinate analysis for t-HOCO isolated in solid argon is reported. In the F-atom reaction studies, the HOC=O HF hydrogen-bonded complex is also stabilized, permitting the comparison of the effects of hydrogen bonding at either end of the molecule. Although there is indirect evidence for the formation of the symmetric H-CO2 species in these experiments, it is not stabilized in concentration sufficient for the identification of its infrared spectrum.

800,375
PB88-217906 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
WKB Potential Well Ground States without Matching.
Final rept.,
C. Leubner, and J. T. Hougen. 1988, 6p
Pub. in Annals of Physics 181, n2 p284-289, 1 Feb 88.

Keywords: *Ground state, Wave functions, Reprints, Vibrational states, WKB approximation.

Schmid has recently conjectured that it might be possible in general to obtain semi-classical (WKB) ground state energies and wavefunctions for various potential surfaces without explicitly considering the problem of how wavefunctions obtained separately in the classically allowed and classically forbidden regions are to be matched across the boundary between those regions. The authors show, by formally expanding the energy as a power series in (\hbar bar) in the usual WKB equations, that even in the one-dimensional case, Schmid's procedure yields an approximate ground state wavefunction only for potential wells which are nearly harmonic, and that the corresponding energy obtained is totally insensitive to any anharmonicity present. Furthermore, excited state wavefunctions cannot be obtained at all. Thus, despite its inherent simplicity, Schmid's method can only be of limited value in the analysis of the dynamics of real molecules on multi-dimensional potential surfaces.

800,376
PB88-217989 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Collisional Transfer within the Sr ((5 sup 3)(P sub J, sup 0)) Multiplet Due to Nearly Adiabatic Collisions with Noble Gases.
Final rept.,
J. F. Kelly, M. Harris, and A. Gallagher. 1988, 7p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Physical Review A 37, n7 p2354-2360, 1 April 88.

Keywords: *Strontium, *Energy transfer, *Rare gases, Atomic energy levels, Collisions, Adsorption, Reprints.

A time-resolved study of the Sr((5 sup 3)(P sub J, sup 0)) intramultiplet collisional mixing, following optical excitation of the (triplet P sub 1, sup 0) state, is presented. The degeneracy-averaged rate coefficients of Sr((5 sup 3)(P sub J, sup 0)) due to collisions with each of the noble gases in a quasiequilibrium cell are derived from least-squares fittings of the triexponential time behavior of ((5 sup 3)(P sub 1, sup 0)) fluorescence and ((5 sup 3)(P sub 2,0)) -> ((6 triplet S sub 1) absorption data. A ((5 sup 3)(P sub 1, sup 0)) radiative rate of 22 ± 0.5 microseconds is also obtained. The dependence of the rates upon buffer pressure demonstrated the presence of both linear and quadratic terms, due to two- and three-body reactions, respectively. The behavior of the binary rate coefficients with varying noble-gas species and temperature is qualitatively consistent with Stuckelberg's model for non-crossing levels.

800,377
PB88-218003 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Multiphoton Ionization Study of Intra- and Intermolecular Effects on the Photodissociation of Methyl Iodide.
Final rept.,
S. P. Sapers, V. Vaida, and R. Naaman. 1988, 8p
Pub. in Jnl. of Chemical Physics 88, n6 p3638-3645, 15 Mar 88.

Keywords: Excitation, Chemical radicals, Reprints, *Methyl iodide, *Multiphoton ionization, *Photodissociation, Valence states.

A time-of-flight mass spectrometer (TOFMS) was used to obtain multiphoton ionization (MPI) mass and wavelength spectra of methyl iodide. The sample was studied in a molecular jet environment which allowed preparation of isolated molecules and/or clusters of different size. Excitation was performed to access the dissociative valence A state and the predissociative Rydberg C state. Valence state excitation produced no TOF ion signal for (CH3 I) sub n, $n = 1$, but produced I2(+) for $n = 2$ and CH3(+) for large n . The presence of CH3(+) is an indication of cluster 'caging' of the chromophore and consequential stabilization of the valence state by intermolecular interactions. REMPI spectra of the Rydberg C state origin and C-I stretch produced results that reflect the longer lifetime of this intermediate state. Spectral line shapes and intensities, and mass fragmentation patterns are discussed in light of the photodissociation dynamics of the intermediate Rydberg state and the effect of intermolecular interactions on the process.

800,378
PB88-218029 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Kinetics of Hydrogen and Hydroxyl Radical Attack on Phenol at High Temperatures.
Final rept.,
Y. Z. He, W. G. Mallard, and W. Tsang. 1988, 6p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Physical Chemistry 92, n8 p2196-2201, 21 Apr 88.

Keywords: *Reaction kinetics, *Phenol, Shock tubes, Hydrogen, Decomposition, Displacement, Yield, Reprints, Hydroxyl radicals, Rate constants, High temperature.

The kinetics of hydrogen and hydroxyl radical attack on phenol have been studied in single-pulse shock tube experiments. The hydrogen atoms are formed through the unimolecular decomposition of hexamethylethane (C8H18) to two tert-butyl radicals which rapidly decompose to hydrogen atoms and isobutene. The hydrogen atoms react with phenol via abstraction of the phenolic hydrogen and displacement of OH. From the yields of isobutene and benzene the authors derive the ratio of the rate for these two processes over the temperature range 1000-1150K and pressures between 2.5 and 5 atm. In the presence of added methane, benzene yield is depressed due to the reaction of hydrogen with methane.

800,379
PB88-218037 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Measurements of the Gas Phase UV Absorption Spectrum of C2H5O2 1+ Radicals and of the Temperature Dependence of the Rate Constant for Their Self-Reaction.
Final rept.,
T. J. Wallington, P. Dagaut, and M. J. Kurylo. 1988, 13p
Contract NASA-W-15816
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Photochemistry and Photobiology A: Chemistry 42, p173-185 1988.

Keywords: *Reaction kinetics, *Free radicals, *Absorption spectra, Absorption cross sections, Photolysis, Measurement, Reprints, *Rate constants, *Ultraviolet absorption, Ethylperoxy radicals.

A flash photolysis technique has been used to measure the gas phase UV absorption cross-sections for C2H5O2 1+ radicals over the wavelength range 215 - 300 nm. Kinetic absorption spectroscopy was then employed to study the self-reaction of these radicals.

800,380
PB88-218185 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Improved (4He I 1snl Ionization Energy, Energy Levels, and Lamb Shifts for 1sns and 1snp Terms.
Final rept.,
W. C. Martin. 1987, 15p
Pub. in Physical Review A 36, n8 p3575-3589, 15 Oct 87.

Keywords: *Atomic energy levels, *Ionization potentials, *Atomic spectra, *Helium, Reprints, Lamb shift.

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The consistencies of calculated term values (ionization energies) for various 1s_n terms having $n=5-8$, $1=1-5$ are tested by microwave-spectroscopic and other available data. The ionization energy E (sub 1) has accordingly been reevaluated by using only the calculated n triplet D term values ($n=4,5$) and available experimental measurements: The resulting E (sub 1) value is 198310.7727(40)/cm with respect to the 2 triplet S level at 159856.07760/cm. Experimental term values based on the new E (sub 1) value are combined with calculated term values not including QED contributions to obtain 'experimental' Lamb shifts for a number of n S and n P terms. The experimental Lamb shifts of the 2 triplet S(1)-2 triplet P(1) and 2 triplet P(1)-2 singlet P(1) separations are also reevaluated.

800,381
PB88-227673 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Rotationally Resolved Product States of Polyatomic Photofragmentation by Time-Resolved FTIR Emission: HF Elimination from 1, 1-CH₂CClF at 193 nm.

Final rept.,
T. R. Fletcher, and S. R. Leone. 1988, 12p
Grants NSF-CHE83-08403, NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC, and Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 88, n8 p4720-4731, 15 Apr 88.

Keywords: *Emission spectroscopy, Photolysis, Hydrogen fluoride, Excitation, Reprints, *Photofragment spectroscopy, *Rotational states, Vibrational states, Collisions, Chlorofluoromethane, Methane/chlorofluoro.

Time-resolved FTIR emission spectroscopy is used to obtain collision-free rotational distributions of the products in a photofragmentation process for the first time. A detailed description of the excimer laser photolysis-FTIR emission method is presented, and results are derived for the internal state distribution of nascent HF eliminated from 1,1-CH₂CClF following photoactivation at 193 nm. The HF product is born rotationally excited, with J (max) at least about $J=15$. The vibrational distribution is also highly excited and fits a Boltzmann distribution with a vibrational temperature of 28,000 K. In the model used, the full exoergicity is assumed; however, the HF vibrational frequency is chosen to be the value in the transition state, which is one-half of the frequency for free HF. Agreement between the statistical model and the observed rotational distributions is less satisfactory, especially for low J states. The results suggest that some modification of the rotational distribution may occur as the HF and HCCl products separate during the photofragmentation.

800,382
PB88-227855 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Molecular Dynamics Evaluation of Cell Models for Type I Gas Hydrate Crystal Dynamics.

Final rept.,
P. K. Basu, and R. D. Mountain. 1988, 2p
Pub. in Jnl. of Phys. Chem. Solids 49, n5 p587-588 1988.

Keywords: *Cell models, *Molecular dynamics, Computerized simulation, Reprints, *Gas hydrates.

The computer simulation technique of molecular dynamics has been used to compare a cell model description of guest atoms in type 1 gas hydrate crystals with a fully dynamical description. The density of states for the guest molecules predicted by the cell model is in poor agreement with the density of states generated by the full dynamics of the system. This indicates that the motion of the guest molecules is strongly coupled to the motion of the host molecules. This implies that a rigid cell model is not a satisfactory basis for the study of guest molecule dynamics.

800,383
PB88-228150 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Steady State Model for the Collision Induced Rotational Alignment of Molecular Ions in Electric Drift Fields.

Final rept.,
H. Meyer, and S. R. Leone. 1988, 13p
Sponsored by Air Force Weapons Lab., Kirtland AFB, NM.

Pub. in Molecular Physics 63, n4 p705-717 1988.

Keywords: *Molecular rotation, Steady state, Mathematical models, Collision cross sections, Alignment, Electric fields, Reprints, Rotation states, Multipoles.

A relationship is derived between the state multipole moments which characterize the deviation in an ensemble of rotors from an isotropic M sub J distribution and the microscopic state multipole cross sections for rotational energy transfer in an atom-diatom system. The result is obtained for cylindrical collision symmetry under steady state conditions. The authors allow for the possibility that the velocity distribution, which is used to calculate the rates, is dependent on the rotational angular momentum quantum numbers J and M sub J . Using an approximate velocity distribution they show how the rotational alignment of molecular ions colliding with a buffer gas in an electric drift field can be related to the zeroth and second order tensor cross sections. The theory is discussed in terms of the rotational alignment resulting when $N_2(1+)$ ions are drifted in He.

800,384
PB88-230354 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Molecular Weight Measured by Scattering Techniques in Random Block Copolymers.

Final rept.,
W. L. Wu, and J. W. Gilmer. 1987, 3p
Pub. in Polymer Communications 28, p202-204 Jul 87.

Keywords: *Molecular weight, *Neutron scattering, Polyethylene terephthalate, Isotopic labeling, Deuterium compounds, Reprints, *Block copolymers, Small angle scattering, Transesterification.

Neutron scattering results of random block copolymers derived from transesterification reactions between deuterated and protonated polyethylene terephthalate were exploited. A quantitative relation between the zero-angle scattering intensity and the extent of transesterification was obtained, based on the assumption of an equal reactivity for deuterated and the protonated species.

800,385
PB88-230370 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Infrared-Active Combination Bands in ArHCl.

Final rept.,
C. M. Lovejoy, and D. J. Nesbitt. 1988, 7p
Grants NSF-CHE86-05970, NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 146, n6 p582-588, 20 May 88.

Keywords: *Infrared spectra, *Vibrational spectra, Rotational spectra, Hydrogen chloride, Excitation, Argon, Spectroscopic analysis, Reprints, *ArHCl, *Van der Waals complexes, *Coriolis interactions, *Ar-HCl, Supersonic expansion.

Ultra-sensitive infrared absorption spectroscopy in a slit supersonic expansion is used to obtain the spectrum of each of the three low-frequency van der Waals vibrations in ArHCl in combination with the n (sub 1) HCl stretch. The (11(sup 1) 0) perpendicular bend is observed to be heavily perturbed by Coriolis interactions both with the nearby (10(sup 0) 1) van der Waals stretch and with the (12(sup 0) 0) parallel bend. The ArHCl complexes formed from ground-state HCl and from vibrationally excited HCl are quite similar, as evidenced by the nearly identical vibrational frequencies and rotational constants for the three corresponding pairs of low-frequency vibrational modes.

800,386
PB88-230396 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Measurement of Isotope Shifts of Two-Photon Transitions in Beryllium.

Final rept.,
J. Wen, J. C. Travis, T. B. Lucatorto, B. C. Johnson, and C. W. Clark. 1988, 6p
Contract DE-AL05-86ER60446
Sponsored by Department of Energy, Washington, DC.
Office of Health and Environmental Research.
Pub. in Physical Review A 37, n11 p4207-4212, 1 Jun 88.

Keywords: *Isotope effect, *Beryllium, Atomic spectra, Photons, Measurement, Reprints, *Multi-photon processes, Resonance ionization mass spectrometry.

The authors have measured (10)Be (9)Be isotope shifts in the Singlet S and Singlet D Rydberg series by resonance-ionization mass spectrometry. Pronounced interference of exchange and correlation contributions to the isotope shift is observed in the Singlet D series, reflecting strong interaction of 2s_{nd} and 2p_{np} channels. The finite-mass correction to the ionization energy of (10)Be is inferred to be 270 + or - 40 MHz.

800,387
PB88-230412 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.

Electron Affinity of MgCl.

Final rept.,
T. M. Miller, and W. C. Lineberger. 1988, 3p
Grants NSF-CHE83-16628, NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 146, n5 p364-366, 13 May 88.

Keywords: *Magnesium chlorides, Spectroscopic analysis, Reprints, *Electron affinity, *Photoelectron spectroscopy.

The electron affinity of MgCl has been measured to be 1.589 + or - 0.011 eV using photoelectron spectroscopy of an MgCl(1-) ion beam. Spectroscopic constants for (X singlet Sigma(1+))MgCl(1-) were found to be Omega(sub e) = 315 + or - 25/cm, r (sub e) = 2.37 + or - 0.01 A, Beta(sub e) = 0.211 + or - 0.002 cm, and D(sub 0)(Mg-Cl(1-)) = 1.27 + or - 0.01 eV. Preliminary results for Mg(1-) are also reported.

800,388
PB88-230503 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Theoretical Calculations of Diatomic Metal Oxides: CrO and CrO(1+).

Final rept.,
P. Jasien, and W. J. Stevens. 1988, 7p
Pub. in Chemical Physics Letters 147, n1 p72-78, 27 May 88.

Keywords: *Molecular theory, *Diatomic molecules, *Chromium oxides, Molecular structure, Computation, Reprints, *Metal oxides, Configuration interaction.

Large scale multireference configuration interaction calculations have been carried out on the (Sup 5) Pi state of the CrO and the (Sup 4) Pi and (Sup 4) Sigma (1-1) states of the CrO(1+) ion. The results for the R (Sub e) and Omega (Sub e) (1.647 A, 850/cm) for CrO are in good agreement with experimentally determined values. In the case of CrO(1+) the (Sup 4)Pi and (Sup 4) sigma (1-) states are found to lie close in energy. The calculated results for the R (Sub e) and Omega (Sub e) for the (Sup 4) Pi (1.622 A, 895/cm) and the (Sup 4) Sigma (1-) (1.638 A, 801/cm) states are in poor agreement with those of experiment, but are consistent with those of another ab initio calculation. In view of this, a reanalysis of the experimental spectrum may be in order.

800,389
PB88-230537 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Molecular Dynamics Study of Liquid CCl₂F₂ and CClH₂F₂.

Final rept.,
R. D. Mountain, and G. Morrison. 1988, 5p
Pub. in Molecular Physics 64, n1 p91-95 1988.

Keywords: *Reaction kinetics, Potential energy, Molecular structure, Reprints, *Molecular dynamics, *Chlorodifluoromethane, *Dichlorodifluoromethane, Methane/chloro-difluoro, Methane/dichloro-difluoro.

Molecular dynamics has been used to establish parameters for effective site-site pair potentials for liquid CCl₂F₂ and for liquid CHClF₂. The parameters were chosen so that the calculated and the experimental values of the pressure and energy agree for liquid states on the liquid-vapor coexistence curve. The structural features predicted by these potentials are similar to those found in simulations of other halogenated methanes.

800,390

PB88-230545

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Structural and Calorimetric Studies of Order-Disorder in CdMg (CO₃)₂.

Final rept.,

C. Capobianco, B. P. Burton, P. M. Davidson, and A. Navrotsky. 1987, 10p

Grants NSF-DMR81-06027, NSF-DMR85-21562

Sponsored by National Science Foundation, Washington, DC.

Pub. in Jnl. of Solid State Chemistry 71, p214-223 1987.

Keywords: *Heat measurement, *Order disorder transformations, X ray diffraction, Quenching(Cooling), Enthalpy, Mathematical models, Cations, Reprints, *Cadmium magnesium carbonate.

The disordering of CdMg(CO₃)₂ was studied near room temperature by powder X-ray diffraction and solution calorimetry using samples quenched from 600 to 850 deg C. The long-range order parameter changes from unity to zero in this range and the enthalpy of disordering is 13.7 ± 0.8 kJ/mole. The enthalpy of formation of ordered CdMg(CO₃)₂ from CdCO₃ and MgCO₃ is -5.6 ± 0.8 kJ/mole; that of the disordered phase is +8.1 ± 0.8 kJ/mole. These data support energetic models which assume positive interactions of Cd and Mg within cation layers and negative interactions (leading to ordering) between layers. A reasonable fit to the observed phase relations is achieved using either the point approximation (PA) of the generalized Bragg-Williams model or the tetrahedron approximation (TA) of the cluster variation method (CVM). These models, however, do not give a quantitative fit to the variation of enthalpy and long-range order parameter with temperature. In particular, the observed order-disorder transition occurs more sharply over a smaller temperature range than predicted, perhaps because of more strongly cooperative behavior in which the carbonate groups as well as the divalent cations play a role.

800,391

PB88-237417

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Interaction of NF₃ with Ru(0001): Order at Steps.

Final rept.,

M. M. Walczak, A. L. Johnson, P. A. Thiel, and T. E. Madey. 1988, 6p

Sponsored by Department of Energy, Washington, DC. Pub. in Jnl. of Vacuum Science and Technology A 6, n3 p675-680 May/Jun 88.

Keywords: *Chemisorption, *Nitrogen fluorides, *Ruthenium, Surface chemistry, Emission, Reprints, Nitrogen trifluoride, Auger electron spectroscopy, Electron stimulated desorption, Low energy electron diffraction, Thermal desorption.

The document is about investigating the adsorption of NF₃ on Ru(0001) using measurements of electron-stimulated desorption ion angular distribution (ESDIAD), low-energy electron diffraction (LEED), thermal desorption spectroscopy, and Auger electron spectroscopy (AES). At 100 K, NF₃ adsorbs with a high sticking probability. Some molecular NF₃ desorbs on heating, with a peak maximum at 200 K. All molecular desorption is complete by 400 K, but AES shows that nitrogen and fluorine remain on the surface up to 1100 K. The LEED pattern of the majority of the surface remains (1x1) at all coverages and annealing conditions. At most locations on the Ru(0001) surface (planar regions), ESDIAD is dominated by F(1+) emission normal to the surface over the temperature range 100-1100 K. On stepped regions of the surface (near edges and defects) highly directional and intense hexagonal patterns of F(1+) emission are observed (200-1100 K). The off-normal beams desorb at 67 deg ± or - 3 deg away from the normal. It appears that most ESDIAD patterns in the system are derived from F or NF_x (x < 3) fragments.

800,392

PB88-238480

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Chemical Engineering Science Div.

Thermodynamics of Ammonium Scheelites. 4. Heat Capacity of Ammonium Metaperiodate NH₄IO₄ from 8 to 324 K.

Final rept.,

R. J. C. Brown, J. E. Callanan, T. L. Haslett, R. D. Weir, and E. F. Westrum. 1987, 6p

See also PB87-163861.

Pub. in Jnl. of Chemical Thermodynamics 19, p711-716 1987.

Keywords: *Thermodynamics, *Specific heat, Reprints, *Ammonium scheelites, *Ammonium metaperiodate, Heat capacity, Metaperiodic acid/ammonia.

The heat capacity of the scheelite salt ammonium metaperiodate, NH₄IO₄, was measured from 8 to 324 K using adiabatic calorimetry. The heat capacity against temperature curve shows an excess with a maximum around 200 K as is typical of other ammonium scheelites. A small peak in the curve near 270 K resulted from melting a saturated aqueous solution trapped in the lattice. Values of the standard molar thermodynamic quantities for NH₄IO₄ are presented up to 320 K.

800,393

PB88-238498

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Chemical Engineering Science Div.

Thermodynamics of Ammonium Scheelites. 5. Heat Capacity of Deuterated Ammonium Metaperiodate ND₄IO₄ from 8 to 329 K.

Final rept.,

R. J. C. Brown, J. E. Callanan, T. L. Haslett, R. D. Weir, and E. F. Westrum. 1987, 6p

See also PB88-238480. Sponsored by Natural Sciences and Engineering Research Council of Canada, Ottawa (Ontario), and Department of National Defence, Ottawa (Ontario).

Pub. in Chemical Thermodynamics 19, p1111-1116 1987.

Keywords: *Thermodynamics, *Specific heat, Deuterium compounds, Reprints, *Ammonium scheelites, *Ammonium Metaperiodate, Heat capacity, Metaperiodic acid/ammonia.

The heat capacity of the scheelite salt: deuterated ammonium metaperiodate, ND₄IO₄, was measured from 8 to 329 K using adiabatic calorimetry. The heat capacity against temperature curve shows a broad maximum with a peak around 200 K which is typical of other ammonium scheelites. A small peak in the curve around 275 K resulted from fusion of a saturated D₂O salt solution trapped in the lattice. Values of the standard molar thermodynamic quantities for ND₄IO₄ are presented up to 330 K.

800,394

PB88-238662

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Laser-Induced Desorption: Thermal and Nonthermal Pathways.

Final rept.,

D. Burgess, R. R. Cavanagh, and D. S. King. 1988, 14p

Contract DE-AI05-84ER13150

Sponsored by Department of Energy, Washington, DC. Pub. in Jnl. of Chemical Physics 88, n10 p6556-6569, 15 May 88.

Keywords: *Desorption, *Nitrogen oxide(NO), Energy levels, Platinum, Kinetic energy, Reprints, *Laser induced desorption.

Distributions of internal states and kinetic energies are reported for the laser-induced desorption of NO from a platinum foil. Two desorption channels are observed, one with internal-state populations which are well fit by Boltzmann distribution functions that correspond to the peak surface temperature. The second desorption channel displays population distributions which are non-Boltzmann: kinetic energies exceed the peak surface temperature by a factor of approx 5; kinetic energies depend on J; the spin-orbit states are inverted; and the vibrational population exceeds that associated with the maximum surface temperature by a factor of 50. The wavelength dependence of the non-Boltzmann desorption signal suggests that a substrate mediated desorption process is operative.

800,395

PB88-238738

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Thermodynamic Comparison of Monomeric and Polymeric C₁₈ Bonded Phases Using Aqueous Methanol and Acetonitrile Mobile Phases.

Final rept.,

A. M. Stalcup, D. E. Martire, and S. A. Wise. 1988, 14p

Pub. in Jnl. of Chromatography 442, p1-14 1988.

Keywords: *Thermodynamics, *Aromatic polycyclic hydrocarbons, Selectivity, Carbinols, Acetonitrile, Entropy, Retarding, Reprints, Liquid chromatography, Stationary phases.

The results of a thermodynamic comparison of the retention of four polycyclic aromatic hydrocarbons on a monomeric and a polymeric reversed-phase column using methanol and acetonitrile are presented. The results are discussed in terms of enthalpic and relative entropic contributions to overall retention.

800,396

PB88-238829

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Ionic Hydrogen Bond and Ion Solvation. 7. Interaction Energies of Carbanions with Solvent Molecules.

Final rept.,

M. Mautner. 1988, 5p

See also PB88-238837. Sponsored by Department of Energy, Washington, DC.

Pub. in Jnl. of the American Chemical Society 110, n12 p3858-3862 1988.

Keywords: *Hydrogen bonds, *Carbanions, *Solvation, Bonding strength, Ions, Solvents, Ligands, Reprints.

The bonding energy of a water molecule to carbanions ranges from 11.0 kcal/mol for c-C₅H₅(1-) to 13-15 kcal/mol for CH₂CN(1-), CH₂CHO(1-), and CH₂COCH₃(1-) and to 16.2 kcal/mol for HCC(1-). Alcohols bond to c-C₅H₅(1-) more strongly, by up to 20.6 kcal/mol for the strongly acidic CF₃CH₂OH, and the attachment energies show an inverse linear correlation with the acidities of the alcohols. The c-C₅H₅(1-) ion exhibits unusual behavior in that it bonds to the hydrogen donor H₂O more weakly (11.0 kcal/mol) than to CH₃CN (15.5 kcal/mol). In contrast, the more localized pyrrolide ion c-C₄H₄N(1-) bonds to the two solvents by comparable strength, 15.8 and 15.7 kcal/mol, respectively. These observations indicate a specific N(1-),OH hydrogen bonding contribution in c-C₄H₄N(1-),H₂O, and/or an unusual C(1-),HC type hydrogen-bonding contribution in c-C₅H₅(1-),CH₃CN.

800,397

PB88-238837

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Ionic Hydrogen Bond and Ion Solvation. 6. Interaction Energies of the Acetate Ion with Organic Molecules. Comparison of CH₃COO(1-) with Cl(1-), CN(1-), and SH(1-).

Final rept.,

M. Mautner. 1988, 5p

See also PB88-238829 and PB88-174123.

Pub. in Jnl. of the American Chemical Society 110, n12 p3854-3858 1988.

Keywords: *Hydrogen bonds, *Acetates, *Solvation, Mass spectroscopy, Ligands, Thermochemistry, Solvents, Bonding strength, Ions, Reprints, Aprotic molecules, Protic molecules, Attachment energy.

The interaction energies of CH₃COO(1-) with protic and aprotic molecules were measured by pulsed high-pressure mass spectrometry. The attachment energies of the first three water molecules are 15.8, 12.8, and 11.8 kcal/mol. The rapid approach to Delta H(sub condn) (H₂O) shows that ionic interactions are accounted for mostly by the first two solvent molecules. CH₃COO(1-) hydrogen bonds strongly to NH acids such as pyrrole, amides, and aniline, with Delta H(sub D, sup 0) = 25-31 kcal/mol. With CH₃CHO, CH₃COCH₃, and CH₃CN as ligands, the attachment energies are 14-16 kcal/mol and the interactions may involve multiple O(1-)-HC bonds. Despite the fact that the ions CH₃COO(1-), Cl(1-), CN(1-), and SH(1-) differ in size, structure, electronegativity, isotropy, and available bonding sites, they bond with similar strengths to most OH, NH, and CH hydrogen donors, from H₂O to large organic molecules such as the dipeptide analogue CH₃CO-Ala-OCH₃. Also, the four ions show

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similar clustering energies with n H₂O and HCN molecules ($n = 1-4$).

800,398

PB88-238845

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Energy Transfer from Vibrationally Excited Pentafluorobenzene to Helium, Xenon and Water Vapor. Final rept.,

T. J. Wallington, P. Dagaut, and W. Braun. 1988, 6p. Pub. in Chemical Physics Letters 144, n3 p299-304, 26 Feb 88.

Keywords: *Helium, *Xenon, *Water vapor, Infrared lasers, Excitation, Mixtures, Energy transfer, Reprints, *Pentafluorobenzene, Benzene/pentafluoro, Vibrational states, Rotational states.

Pulsed infrared laser irradiation was used to excite pentafluorobenzene (PFB) in mixtures with helium, argon and water vapor. Measurements of the rates of energy transfer were made as a function of the initial laser excitation energy, total pressure, and composition of the gas mixture using the Hg tracer technique. The results are discussed with respect to the transfer of energy between vibrational, rotational, and translational degrees of freedom.

800,399

PB88-239405

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Detailed Energy Transfer Mechanism in Pentafluorobenzene/Argon Mixtures. Final rept.,

W. Braun, and T. J. Wallington. 1987, 6p. Pub. in Chemical Physics Letters 140, n5 p441-446, 16 Oct 87.

Keywords: *Argon, Infrared lasers, Excitation, Collision research, Carbon dioxide lasers, Doppler effect, Energy transfer, Mixtures, Reprints, *Pentafluorobenzene, Benzene/pentafluoro.

Energy transfer, following IR laser excitation, was studied in mixtures of pentafluorobenzene (PFB) and argon employing a new method that uses Lorentz and Doppler broadening of the Hg multiplet lines near 254 nm to sense temporal translational energy changes. From such measurements, as a function of initial laser excitation energy, pressure and composition of the gas mixture, the authors derive specific collision efficiencies for the interchange of energy between vibrational, rotational and translational degrees of freedom in the mixture.

800,400

PB88-239413

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Flash Photolysis Investigation of the UV Absorption Spectrum and Self-Reaction Kinetics of CH₂ClCH₂O₂ Radicals in the Gas Phase. Final rept.,

P. Dagaut, T. J. Wallington, and M. J. Kurylo. 1988, 7p. Contract NASA-W-15816. Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in Chemical Physics Letters 146, n6 p589-595, 20 May 88.

Keywords: *Ultraviolet spectra, *Reaction kinetics, Vapor phases, Absorption cross sections, Reprints, *Flash photolysis, *Chloro-ethylperoxy radicals, Rate constants, Ultraviolet absorption, Atmospheric chemistry.

The ultraviolet absorption spectrum of the chloro-ethylperoxy radical, CH₂ClCH₂O₂, and the kinetics of its self-reaction have been studied in the gas phase using a flash photolysis technique. The room temperature absorption cross section at 250 nm was determined, and was used to calculate an observed self-reaction rate constant, independent of pressure over the range 25-400 Torr. Data over the temperature range 228-380 K and at a total pressure of 100 Torr were used to obtain the Arrhenius expression.

800,401

PB88-239421

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Rate Constant for the Gas Phase Reactions of OH with C5 through C7 Aliphatic Alcohols and Ethers: Predicted and Experimental Values. Final rept.,

T. J. Wallington, P. Dagaut, R. Liu, and M. J. Kurylo. 1988, 7p. Contract NASA-W-15816. Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in International Jnl. of Chemical Kinetics 20, p541-547 1988.

Keywords: *Reaction kinetics, *Aliphatic compounds, Monohydric alcohols, Ethers, Chemical reactivity, Pentanols, Reprints, *Hydroxyl radicals, *Combustion kinetics, Flash photolysis, Resonance fluorescence, Butanols/methyl, Hexanols, Heptanols, Methyl butyl ethers, Ethyl butyl ethers, Methyl amyl ethers.

Absolute rate constants were determined at 298 K for the gas phase reactions of hydroxyl radicals with several C5 through C7 aliphatic alcohols and ethers using the flash photolysis resonance fluorescence technique. The values obtained have been presented. These results are discussed in terms of group reactivities in such molecules and are compared with values estimated from an additive structure-reactivity index.

800,402

PB88-239439

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Interfacial Tension and Vapor-Liquid Equilibria in the Critical Region of Mixtures. Final rept.,

M. R. Moldover, and J. C. Rainwater. 1988, 9p. Contract NASA-W-16170. Sponsored by National Aeronautics and Space Administration, Washington, DC., and Department of Energy, Washington, DC. Pub. in Jnl. of Chemical Physics 88, n12 p7772-7780, 15 Jun 88.

Keywords: *Interfacial tension, Critical point, Thermodynamic equilibrium, Binary systems(Materials), Carbon dioxide, Butanes, Critical pressure, Critical temperature, Critical density, Composition(Property), Isotherms, Reprints, *Liquid-vapor equilibrium.

In the critical region, the concept of two-scale-factor universality can be used to accurately predict the surface tension between near-critical vapor and liquid phases from the singularity in the thermodynamic properties of the bulk fluid. In the present work, this idea is generalized to binary mixtures and is illustrated using the data of Hsu, Nagarajan, and Robinson for CO₂ + n -butane. The authors fit the pressure-temperature-composition-density data for coexisting, near-critical phases of the mixtures with a thermodynamic potential comprised of a sum of a singular term and nonsingular terms. The nonuniversal amplitudes characterizing the singular term for the mixtures are obtained from the amplitudes for the pure components by interpolation in a space of thermodynamic 'field' variables. The interfacial tensions predicted for the mixtures from the singular term are within 10 percent of the data on three isotherms in the pressure range ((P sub c) - P)/(P sub c) < 0.5. This difference is comparable to the combined experimental and model errors.

800,403

PB88-239587

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Identification of Corona Discharge-Induced SF₆ Oxidation Mechanisms Using SF₆ (18)O₂ H₂(16)O and SF₆ (16)O₂ H₂(18)O Gas Mixtures. Final rept.,

R. J. VanBrunt, and M. C. Siddagangappa. 1988, 17p. Sponsored by Department of Energy, Washington, DC. Pub. in Plasma Chemistry and Plasma Processing 8, n2p207-223 1988.

Keywords: *Electric corona, *Sulfur hexafluoride, *Oxidation, Mixtures, Gas chromatography, Isotope labeling, Mass spectrometers, Free radicals, Reprints.

The absolute yields of gaseous oxyfluorides SOF₂, SO₂F₂, and SOF₄ from negative, point-plane corona discharges in pressurized gas mixtures of SF₆ with O₂ and H₂O enriched with (18)O₂ and H₂(18)O have been measured using a gas chromatograph-mass spectrometer. The predominant SF₆ oxidation mechanisms have been revealed from a determination of the relative (18)O and (16)O isotope content of the observed oxyfluoride by-products. The results are con-

sistent with previously proposed production mechanisms and indicate that SOF₂ and SO₂F₂ derive oxygen predominantly from H₂O and O₂, respectively, in slow, gas-phase reactions involving SF₄, SF₃, and SF₂ that occur outside of the discharge region. The species SOF₄ derives oxygen from both H₂O and O₂ through fast reactions in the active discharge region involving free radicals or ions such as OH and O, with SF₅ and SF₄.

800,404

PB88-239595

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Transfer of F(1-) in the Reaction of SF₆(1-) with SOF₄: Implications for SOF₄ Production in Corona Discharges. Final rept.,

R. J. Van Brunt, L. W. Sieck, I. Sauters, and M. C. Siddagangappa. 1988, 22p. Sponsored by Department of Energy, Washington, DC. Pub. in Plasma Chemistry and Plasma Processing 8, n2 p225-246 1988.

Keywords: *Chemical reactions, *Sulfur fluorides, *Sulfur oxides, *Electric corona, Mixtures, Sulfur hexafluoride, Reaction kinetics, Reprints, *Sulfur monooxytetrafluoride, Rate constants.

The temperature (T) and electric field-to-gas pressure (E/P) dependences of the rate coefficient k for the reaction SF₆(1-) + SOF₄ -> SOT-5(1-) + SF₅ have been measured. The measured rate coefficient is used to estimate the influence of this reaction on SOF₄ production from negative, point-plane glow-type corona discharges in gas mixtures containing SF₆ and at least trace amounts of O₂ and H₂O. It is found that the contribution of SF₆(1-) + SOF₄ to SOF₄ destruction falls considerably below the estimated maximum effect assuming that SF₆(1-) is the predominant charge carrier which reacts only with SOF₄. The results of the analysis suggest that SF₆(1-) is efficiently deactivated by other reactions, and the influence of SF₆(1-) + SOF₄ on SOF₄ production is not necessarily more significant than that of other slower secondary processes such as gas-phase hydrolysis.

800,405

PB89-101315

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.

Wetting Layers in Electrolyte Solutions. Final rept.,

R. F. Kayser. 1988, 5p. Contract NASA-H-27954-B. Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in Jnl. of Physics France 49, p1027-1031 1988.

Keywords: *Aqueous electrolytes, *Inorganic salts, *Surfactants, Concentrations(Composition), Interfaces, Ionization, Thermodynamic equilibrium, Reprints, *Wetting layers.

When a predominantly nonpolar mixture is in contact with a chemically ionizable substrate, thick wetting layers of a predominantly polar phase can form on the substrate. The paper considers the effects of added salt on such layers. In the limit of low salt concentrations, the equilibrium thickness reduces to a result previously derived by the author. In the limit of high salt concentrations, the thickness reduces to a Debye screening length times a known function of two dimensionless parameters.

800,406

PB89-101372

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Bismuth Valence Order-Disorder Study in BaBiO₃ by Powder Neutron Diffraction. Final rept.,

C. Chailout, A. Santoro, J. P. Remeika, A. S. Cooper, G. P. Espinosa, and M. Mavezio. 1988, 7p. Pub. in Solid State Communications 65, n11 p1363-1369 1988.

Keywords: *Bismuth, *Neutron diffraction, *Molecular structure, *Valence, Reprints, *Order-disorder transformations, Barium bismuth oxides.

Two structural arrangements have been shown to exist for the perovskite-like compound BaBi(sub .5) (sup +3) Bi(sub .5) (sup +5) O(sub 3) by powder neutron diffraction data. The first is characterized by a par-

tial (75 percent) order of the Bi(sup +3) and Bi(sup +5) cations on the two crystallographically independent sites, while in the second arrangement the two cations are almost 100 percent disordered. The structure of eleven differently-prepared BaBiO₃ samples showed that the deciding factor for obtaining one or the other arrangement is the temperature at which the sample is prepared or subsequently heat-treated.

800,407

PB89-101430 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Neutron and Electron Diffraction Study of YBa₂Cu₃O₇(0.77)Fe(0.23)O(7.13).

Final rept.,
P. Bordet, J. L. Hodeau, P. Strobel, M. Marezio, and A. Santoro. 1988, 5p
Pub. in Solid State Communications 66, n4 p435-439 1988.

Keywords: *Neutron diffraction, *Electron diffraction, *Crystal structure, Superconductors, Cations, Reprints, *Yttrium barium copper ion oxides.

The compound of formula YBa₂Cu₂7Fe_{0.3}O_{7.13} has been analyzed by neutron and electron diffraction techniques. The material is tetragonal with lattice parameters $a = b = 3.8674(1)$, $c = 11.6687(2)$ Å and space group P4/mmm. The Fe cations substitute only the Cu cations located on the basal plane of the structure and can adopt three different types of coordination (tetrahedral, pyramidal and octahedral) depending upon the content and distribution of the extra oxygen atoms on the plane.

800,408

PB89-101539 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Structure of a Fluid Interface Near the Critical Point.

Final rept.,
J. W. Schmidt. 1988, 4p
Contract NASA-H-27954-B
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Physical Review A 38, n1 p567-570, 1 Jul 88.

Keywords: *Fluid mechanics, *Critical point, *Molecular structure, Carbon disulfide, Cyclohexane, Carbinols, Nitrobenzenes, Decanes, Mixtures, Fluid flow, Deuterium compounds, Reprints, Methyl alcohol, Benzene/nitro, Decane.

The structure of the liquid-liquid interface of three very different mixtures (carbon disulfide + methanol, methanol + cyclohexane + deuterated cyclohexane, and nitrobenzene + n-decane) has been studied using ellipsometry in the reduced temperature range $0.0009 < t < 0.042$. Although the elliptical thickness varies by an order of magnitude between these mixtures, the data from all three mixtures can be scaled to the same universal constant by a combined meanfield plus capillary-wave model of the interface. The universal constant determined experimentally is significantly less than the theoretical value.

800,409

PB89-101562 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Kinetics Investigation of the Gas-Phase Reactions of OH Radicals with Cyclic Ketones and Diones: Mechanistic Insights.

Final rept.,
P. Dagaut, T. J. Wallington, R. Liu, and M. J. Kurylo. 1988, 3p
Contract NASA-W-15816
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Physical Chemistry 92, n15 p4375-4377, 28 Jul 88.

Keywords: *Reaction kinetics, *Atmospheric chemistry, *Ketones, Combustion, Aromatic compounds, Photolysis, Reprints, *Hydroxyl radicals, *Diones, *Fluorescence spectroscopy.

Absolute rate constants for the gas-phase reactions of hydroxyl radicals with several cyclic ketones and diones were determined by the flash photolysis resonance fluorescence technique. A discussion of these results in relation to earlier measurements for simple aliphatic ketones yields further mechanistic insights for hydroxyl radical-ketone reactions in the gas phase.

800,410

PB89-101570 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Tunneling Splittings in the Water Dimer: Further Development of the Theory.

Final rept.,
L. H. Coudert, and J. T. Hougen. 1988, 34p
Pub. in Jnl. of Molecular Spectroscopy 130, p86-119 1988.

Keywords: *Water, *Molecular energy levels, *Molecular rotation, *Electron tunneling, Deuterium compounds, Hydrogen bonds, Reprints, *Dimers, Tunnel effect.

Energy level expressions are derived for the hydrogen-bonded water dimer complex and some of its deuterated species, using a previously reported internal-axis-method-like formalism developed for high barrier tunneling problems involving several large-amplitude motions. First, the feasibility of various tunneling motions is considered, using a potential surface given by D. F. Coker and R. O. Watts (J. Phys. Chem. 91, 2513-2518 (1987)), and three main tunneling paths for (H₂O)₂ are chosen. As the second step, the J and K dependence of the purely vibrational tunneling splittings, which arises in the IAM-like formalism because angular momentum is generated during the tunneling motions. Finally, the Hamiltonian matrix is set up and diagonalized to obtain the desired energy level expressions (used without proof in an earlier paper treating observed microwave transitions of (H₂O)₂). The J and K dependence of the tunneling splittings arising from the presence of rotational terms in the effective Hamiltonian operator is also discussed, but only for the most symmetric species (H₂O)₂ and (D₂O)₂.

800,411

PB89-101588 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Heterodyne and FTS Measurements on the OCS Hot Bands Near 1890 cm⁻¹.

Final rept.,
A. G. Maki, W. B. Olson, J. S. Wells, and M. D. Vanek. 1988, 12p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 130, p69-80 1988.

Keywords: *Demodulation, Molecular vibrations, Molecular rotations, Reprints, *Carbonyl sulfide, *Fourier transform spectroscopy, Chemical shifts(Energy levels).

New infrared heterodyne frequency measurements are reported for carbonyl sulfide (OCS) near 1890/cm. By combining these heterodyne measurements with microwave measurements reported in the literature and with new Fourier transform spectrometer measurements, the authors have determined rovibrational constants for the states. A separate set of measurements was made to determine the pressure shift of the transitions in the O₂(sup 0) 0-0 (sup 0) 0 band of OCS.

800,412

PB89-101596 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Fourier Transform Infrared Spectroscopy of the BO₂ Radical.

Final rept.,
A. G. Maki, J. B. Burkholder, A. Sinha, and C. J. Howard. 1988, 11p
Pub. in Jnl. of Molecular Spectroscopy 130, p238-248 1988.

Keywords: *Infrared spectroscopy, *Free radicals, Boron oxides, Absorption spectra, Molecular energy levels, Reprints, *Boron dioxide, *Fourier transform spectroscopy.

The absorption spectrum of BO₂ in the ground state, sigma (sup 2) Pi, has been measured in the infrared with a high-resolution Fourier transform spectrometer. The O₀(sup 0) 1-00(sup 0) 0 and 10(sup 0) 1-00(sup 0) 0 vibrational transitions have been measured for both the (sup 2)Pi(sub 1/2) and the (sup 2)Pi(sub 3/2) states. Because of the large number of vibronic levels arising from the Renner-Teller effect, there is a high likelihood of observing level crossings in the molecule and three examples of perturbations in these states are described. Improved ground state constants are reported.

800,413

PB89-101604 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

CO(v=1) Population Lifetimes of Metal-Carbonyl Cluster Compounds in Dilute CHCl₃ Solution.

Final rept.,
E. J. Heilweil, R. R. Cavanagh, and J. C. Stephenson. 1988, 10p
Pub. in Jnl. of Chemical Physics 89, n1 p230-239, 1 Jul 88.

Keywords: *Carbon monoxide, *Metal carbonyls, *Molecular vibrations, *Molecular relaxation, *Complex compounds, Chloroform, Reprints, *Lifetime, Picosecond pulses.

Tunable infrared picosecond pulses in the 5 micro region have been used for time-resolved pump-probe measurements of the population relaxation lifetime (T₁) of CO(nu=1) stretching vibrations in a series of metal-carbonyl cluster compounds in room temperature chloroform solution. The long CO(nu=1) T₁ values for the metal cluster molecules suggest relaxation via multiquantum transfer of vibrational energy to adjacent M-C stretch and M-C-O bend vibrations; energy transfer to vibrational or electronic states of the central metal core seems unimportant in determining T₁ for these systems.

800,414

PB89-101612 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Vibrational Predissociation in the CO₂ Dimer and Trimer and Rare Gas - CO₂ Complexes.

Final rept.,
A. S. Pine, and G. T. Fraser. 1988, 10p
Pub. in Jnl. of Chemical Physics 89, n1 p100-109, 1 Jul 88.

Keywords: *Carbon dioxide, *Complex compounds, *Molecular vibration, *Rare gas compounds, Dissociation, Energy transfer, Reprints, *Optothermal spectroscopy, Dimers, Trimers, Laser spectroscopy.

Vibrational predissociation linewidths for the CO₂ dimer and trimer and the Ne-CO₂ and Ar-CO₂ complexes have been resolved using a bolometer-detected (optothermal) molecular-beam color-center laser spectrometer. The results indicate that V yields V energy transfer processes are the dominant predissociation channels with symmetry selection or propensity rules and specific resonances playing a role.

800,415

PB89-101737 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

NMR Study of Gels of Isotactic Polystyrene and Cis- or Trans-Decalin.

Final rept.,
E. Perez, D. VanderHart, and G. McKenna. 1988, 15p
Pub. in Macromolecules 21, n8 p2418-2432 1988.

Keywords: *Nuclear magnetic resonance, *Gels, *Decalin, *Polystyrene, Stereochemistry, Crystallization, Comparisons, Reprints.

Samples consisting of a high molecular weight (M(sub w)=1.4 x 10 to the 6th power) isotactic polystyrene (iPS) mixed, 25% by weight, with cis- or trans-decalin have been investigated by proton and (sup 13)C NMR. The most studied samples were gels formed by quenching the solutions to 253 K, although some data on gels formed at 296 K are also reported. Comparison is further made with samples crystallized at 347 K. Most of the NMR data were obtained on nonspinning samples, although magic angle spinning was attempted on one gel sample. Variable-temperature proton spectra covered the range from solvent freezing to gel melting temperatures. The principal motivation was to investigate the nature of the iPS-rich phase in the gels since previous studies have claimed evidence either for a crystal structure different from the usual 3 (sub 1) helix or for a polymer/solvent complex. It was shown that the NMR behavior of the gel is very different from that of a preparation of solution-crystallized iPS.

800,416

PB89-101752 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

CHEMISTRY

Physical & Theoretical Chemistry

Adsorption on Hydroxyapatite: Role of Hydrogen Bonding and Interphase Coupling.

Final rept.,
D. N. Misra. 1988, 6p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in *Langmuir* 4, n4 p953-958 Jul/Aug 88.

Keywords: *Hydrogen bonds, *Surface chemistry, *Dental materials, Solvents, Adsorption, Irreversible processes, Reprints, *Apatite/hydroxy, Thermodynamic coupling, Reversing.

The adsorptive properties of a number of compounds possessing hydroxyl and/or carboxylate groups were studied on hydroxyapatite (with hydrated surface) from different solvents at room temperature. Generally, it was found that the compounds were adsorbed reversibly from hydrogen-bonding and irreversibly from non-hydrogen-bonding solvents. A reasonable interpretation is that the appropriate functional groups of the adsorbate molecules are hydrogen-bonded to the apatite surface. In all cases the reversible adsorption may be represented by the Langmuir plots, and it is deduced that the orientation of the hydrocarbon moieties (including benzene rings) of an adsorbate molecule is parallel to the substrate if it is geometrically possible. The irreversible isotherms are characterized by a total adsorption from dilute solutions below a threshold concentration and a constant adsorption above the threshold. The hydrocarbon moieties are oriented away from the surface for irreversibly adsorbed molecules. All compounds were commercially available except for ferric methacrylate, which was synthesized and may act as an interphase coupling agent between a dental resin and hydroxyapatite. No significant gain was shown, however, in diametral tensile strength of a polymer filled with synthetic hydroxyapatite coated with irreversibly adsorbed ferric methacrylate as compared to that of the polymer filled with the clean apatite.

800,417
PB89-107064 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Response to Dr. E. I. F. Pearce's Letter to the Editor.
Final rept.,
L. C. Chow. 1988, 2p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in *Jnl. of Dental Research* 67, n7 p1058-1059 Jul 88.

Keywords: Dissolving, *Calcium phosphates, Reaction kinetics, Thermodynamic equilibrium, *Solubility, Reprints.

Although the questions raised in Dr. Pearce's letter do illustrate that the dissolution properties of hydroxyapatite (OHAp) are complex and sometimes perplexing, there are no real contradictions in the findings reported by the various investigators and the dissolution mechanisms they proposed. Much of the confusion arises when the authors try to treat the solubility and the rate of dissolution of OHAp as two aspects of the same property. The fact, however, is that solubility is an equilibrium property and rate of dissolution is a kinetic property. While the two are often related, they are influenced by quite different sets of parameters. The solubility of OHAp can adequately be described by the principle of solubility product constant. The treatments of rate of dissolution, on the other hand, would require the use of certain mechanistic models in addition to thermodynamic terms.

800,418
PB89-107130 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Laser Double-Resonance Measurements of Rotational Relaxation Rates of HF(J=13) with Rare Gases, H₂ and D₂.
Final rept.,
C. A. Taatjes, and S. R. Leone. 1988, 7p
Grants NSF-CHE84-08043, NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in *Jnl. of Chemical Physics* 89, n1 p302-308, 1 Jul 88.

Keywords: *Hydrogen fluoride, *Molecular relaxation, *Rare gases, Reaction kinetics, Molecular rotation, Hydrogen, Deuterium, Reprints, *Molecule-molecule collisions, *Laser spectroscopy, *Double resonance methods.

Rotational relaxation rates for HF ($\nu = 0$, $J = 13$) colliding with rare gases (He, Ne, Ar, Kr, Xe), H₂, and D₂ are measured using a transient-absorption double-resonance technique. The relaxation rate constants with rare gases (rotation-to-translation, R-T) decrease dramatically through the series He-Ne-Ar, then increase substantially through the series Ar-Kr-Xe, revealing the increased effectiveness of either highly impulsive or highly attractive collisions.

800,419
PB89-107197 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Near-Infrared Spectrum of NeHCl.
Final rept.,
C. M. Lovejoy, and D. J. Nesbitt. 1988, 7p
Grants NSF-PHY86-04504, NSF-CHE86-05970
Sponsored by National Science Foundation, Washington, DC.
Pub. in *Chemical Physics Letters* 147, n5 p490-496, 17 Jun 88.

Keywords: *Near infrared radiation, *Infrared spectra, Van der Waals equation, Neon compounds, Molecular rotation, Hydrochloric acid, Reprints, *Neon hydrochloric acid.

The near-infrared spectrum of jet-cooled NeHCl is reported. The HCl stretching fundamental and three combination bands are observed and analyzed to determine rotational constants and vibrational frequencies including those of the van der Waals stretching and bending modes. An unusual intensity distribution is observed, in which the fundamental is weak and the combination bands are strong; in part this is the result of nearly free internal rotation of the HCl subunit within the complex.

800,420
PB89-114284 PC A07/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Technical Activities 1986, Surface Science Division.
C. J. Powell. Dec 86, 127p NBSIR-86/3491
See also PB88-169453.

Keywords: *Surface chemistry, Standards, Catalysis, Electron spectra, Surface energy, Measurement, *Surface physics.

The report summarizes technical activities of the NBS Surface Science Division during Fiscal Year 1986. These activities include surface-standards work, experimental and theoretical research in surface science, the development of improved measurement methods, and applications to important scientific and national problems. A listing is given of publications, talks, professional committee participation, and professional interactions by the Division staff.

800,421
PB89-118822 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Spectrum and Energy Levels of Eight-Times Ionized Rubidium (Rb IX).
Final rept.,
S. Goldsmith, J. Reader, and N. Acquista. 1984, 4p
Sponsored by Department of Energy, Washington, DC. Office of Magnetic Fusion Energy.
Pub. in *Jnl. of the Optical Society of America B: Optical Physics* 1, n4 p631-634 1984.

Keywords: *Spectrum analysis, *Atomic energy levels, Ionization, Hartree-Fock approximation, Ultraviolet spectroscopy, Reprints, *Rubidium ions.

The spectrum of the copperlike ion Rb IX was observed with a low-inductance spark in the region 70-630 Å with the 10.7-m grazing incidence spectrograph at the National Bureau of Standards. From the identification of 18 lines a system of 16 energy levels of the type 3d(sup 10) micro I was determined. The observed energy levels are compared with relativistic and non-relativistic Hartree-Fock calculations.

800,422
PB89-118830 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Transitions of the Type 2s-2p in Oxygenlike Y, Zr, and Nb.

Final rept.,
W. E. Behring, C. M. Brown, U. Feldman, J. F. Seely, J. Reader, and M. C. Richardson. 1986, 3p
Pub. in *Jnl. of the Optical Society of America B: Optical Physics* 3, n8 p1113-1115 1986.

Keywords: *Atomic energy levels, Ions, Magnetic dipoles, Reprints, *Yttrium ions, *Niobium ions, *Zirconium ions, Energy-level transitions.

Transitions of the type 2s-2p in the oxygenlike ions Y XXXII, Zr XXXIII, and Nb XXXIV have been identified in spectra recorded at the University of Rochester's Omega laser facility. Solid targets were spherically irradiated by 24 beams of frequency-tripled (351 nm) Nd:glass laser radiation. The spectra were photographed with a 3 meter grazing-incidence spectrograph. The identified transitions of the 0-like ions are in the range of 30 Å to 73 Å. The wavelengths for the magnetic dipole transitions within the 2s(sup 2) p(sup 4) ground configurations of these ions are predicted from the experimental energy levels.

800,423
PB89-118889 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Process Metrology Div.
Surface Acoustic Wave Microsensors Using Diffused Substrates.
Final rept.,
P. H. Huang. 1988, 6p
Pub. in *IEEE (Institute of Electrical and Electronic Engineers) Transactions on Electron Devices* 35, n6 p744-749 Jun 88.

Keywords: *Substrates, *Waveguides, Measuring instruments, Diffusion, Detectors, Performance evaluation, Reprints, *Surface acoustic wave microsensors, *Lithium niobates.

Various YZ-LiNbO₃ substrate configurations have been investigated to develop efficient ways of confining the wave energy in surface acoustic wave (SAW) microsensors based on waveguide structure. The core and cladding regions for the SAW waveguide sensors have been titanium in-diffused or out-diffused and in some cases metal overlays have been used. By varying the diffusion conditions, the SAW velocities in these regions can be controlled such that a channelled region with interface wave reflection is produced while minimizing the wave velocity difference between the cladding and the core.

800,424
PB89-118905 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Relative Thermochemical Stabilities and Reactivities of Benzo(A)pyrene and Selected Isomers.
Final rept.,
A. Greenberg, S. E. Stein, and R. L. Brown. 1984, 12p
Pub. in *Science of the Total Environment* 40, p219-230 1984.

Keywords: *Enthalpy, *Pyrenes, *Aromatic polycyclic hydrocarbons, Thermodynamics, Computation, Molecular orbitals, Air pollution, Thermochemistry, Reprints, Benzo(A)pyrene.

Gas-phase standard enthalpies of formation are calculated for benzo(A)pyrene and thirty-two isomeric polycyclic aromatic hydrocarbons including compounds having four-, five- and seven-membered rings. Additionally, reactivity data are summarized and include experimental ionization potentials, Hückel highest occupied molecular orbitals and selected reactivity indices. These data are compared with reported levels of those C₂₀H₁₂ hydrocarbons reported in the atmosphere. These thermodynamic and kinetic parameters are useful reference points for understanding the stabilities of airborne PAH. Additionally, the data tabulations may be useful in predicting the existence of PAH not yet reported in environmental samples.

800,425
PB89-119028 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Cation Binding Effect on Imidazole Tautomerism. Final rept., H. Basch, M. Krauss, and W. J. Stevens. 1987, 11p. Pub. in International Jnl. of Quantum Chemistry 31, n3 p405-415 1987.

Keywords: *Cations, *Chemical bonds, *Isomerization, *Zinc, Imidazoles, Inorganic salts, Perturbation, Reprints, *Molecular conformation, *Imidazole, *Imidazole/methyl.

Binding of Zn(+2) to imidazole (Im) and methyl imidazole (Melm) is studied by ab initio methods as a model for the effect of cation binding on tautomeric energies. Gradient energy optimized conformations were obtained for all neutral and ionic structures including the deprotonated molecules and the ylides. Binding of Zn(+2) produces a significant perturbation in the electronic structure, a smaller shift in the equilibrium conformation of the imidazole ring, and only a small absolute shift in the relative tautomer energies. Methyl substitution at C5 has a small effect on both conformation and energetics. A high energy ylide tautomer is produced by moving the proton bound to C2 to the N1 atom. The binding of Zn(+2) to the C2 site is substantially stronger than to the N1 site yielding nearly isoenergetic ZnIm(+2) conformations for binding to either N or C atoms. For the deprotonated salts the lowest energy conformation has the C2-N3 bond bridged by Zn(=2).

800,426

PB89-119036 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Doppler-Limited Spectra of the C-H Bending Overtone of Fluoromethane.
Final rept., A. S. Pine, and J. Pliva. 1988, 14p. Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in Jnl. of Molecular Spectroscopy 130, p431-444 1988.

Keywords: *Infrared spectroscopy, *Doppler effect, Perturbation, Chemical bonds, Fluorine organic compounds, Reprints, *Methane/trifluoro, *Laser spectroscopy, Fluoromethane.

The parallel (A1) and perpendicular (E) bands of the C-H bending overtone, 2 nu(sup 4) of CHF3 have been recorded at Doppler-limited resolution at room temperature using a difference-frequency laser spectrometer.

800,427

PB89-119044 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Microwave Spectrum of the CH3OH-NH3 Complex.
Final rept., G. T. Fraser, R. D. Suenram, F. J. Lovas, and W. J. Stevens. 1988, 13p. Pub. in Chemical Physics 125, p31-43 1988.

Keywords: *Microwave spectroscopy, *Complex compounds, *Ammonia, Carbinols, Molecular rotation, Van der Waals equation, Hydrogen bonds, Dipole moments, Reprints, *Fourier transform spectroscopy, *Methyl alcohol.

Microwave spectra of CH3OH-NH3 and (sup 13)CH3OH-NH3 have been obtained using a pulsed-nozzle Fourier-transform microwave spectrometer. The spectra, which are complicated by the internal rotation of the CH3 and NH3 groups, exhibit five K=O states at approximately 1 K rotational temperature of the expansion. Four of these are metastable, excited internal rotor states and correlate to E states of free CH3OH or NH3. For the two states in which the NH3 top is in its ground internal rotor state, delta J=1, K=O progressions are observed and fit to linear-molecule-type frequency expressions to obtain effective spectroscopic constants. Ab initio SCF calculations have also been carried out for the CH3OH-NH3 and HOH-NH3 complexes in order to compare interaction-energy components and origins of the dipole moment enhancements.

800,428

PB89-119069 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Diffusion Bonding of Ductile Single Crystals for Strain Free Mounting.

Final rept., D. B. Black, H. E. Burdette, and J. G. Early. 1986, 2p. Pub. in Jnl. of Applied Crystallography 19, pt4 p279-280, 1 Aug 86.

Keywords: *Diffusion welding, *Single crystals, *Strains, *Deformation, Substrates, High temperature tests, Reprints.

A technique is described to mount delicate metal single crystals without introducing strain or deformation. The technique involves the formation of a diffusion bond between the crystal and a substrate material at elevated temperature. Results for copper single crystals mounted to polycrystalline copper substrates are discussed.

800,429

PB89-119192 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Stabilization of alpha-Mn Structures in New Ternary chi Phases.
Final rept., R. M. Waterstrat, and R. Kuentzler. 1988, 6p. Sponsored by American Dental Association Health Foundation, Chicago, IL. Pub. in Jnl. of the Less-Common Metals 142, p163-168 1988.

Keywords: *Superconducting, *Molecular structure, *Ternary systems, *Intermetallic compounds, Specific heat, Stability, Ruthenium containing alloys, Osmium containing alloys, Manganese, Reprints.

New superconducting X phases have been discovered in the as-cast alloys Ru29Mo19Zr10, Ru23Rh6Mo19Zr10 and Os29W19Hf10. Measurements of low temperature specific heat were carried out on these phases, and the principles underlying the stability of this peculiar structure type are discussed, with a view towards the prediction of further X-phase compounds.

800,430

PB89-119226 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Ultrasensitive Laser Isotope Analysis of Krypton in an Ion Storage Ring.
Final rept., R. E. Bonanno, J. J. Snyder, T. B. Lucatorto, P. H. Debenham, and C. W. Clark. 1987, 6p. Pub. in Resonance Ionization Spectroscopy 1986, Proceedings of the International Symposium (3rd), Swansea, Wales, September 7-12, 1986 p85-90 1987.

Keywords: *Krypton isotopes, Mass spectroscopy, Isotope separation, *Laser isotope separation, *Laser ionization mass spectroscopy.

The authors are developing a new instrument for ultrasensitive isotope analysis that combines magnetic mass selection, resonant charge exchange, and laser reionization. For krypton, the technique is expected to achieve isotope abundance sensitivities greater than 10 to the -12th power.

800,431

PB89-119234 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Analytic Representation of the Silicon Absorption Coefficient in the Indirect Transition Region.
Final rept., J. C. Geist, A. Migdall, and H. P. Baltes. 1988, 3p. Pub. in Applied Optics 27, n18 p3777-3779, 15 Sep 88.

Keywords: *Silicon, *Absorptivity, Absorption spectra, Experimental design, Reprints.

Identifiers: An eleven parameter equation is presented to describe the 298 K experimental silicon absorption coefficient data of Weakliem and Redfield from 1.05 eV to 2.7 eV. The standard deviation of the difference between one and the ratio of the values calculated from this equation to the Weakliem and Redfield experimental values for the same photon energies is 2.5%.

800,432

PB89-119422 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Emission Spectra of an Azide Photoresist Initiator and Exposure Reciprocity.

Final rept., D. B. Novotny. 1988, 2p. Pub. in Jnl. of the Electrochemical Society 135, n3 p774-775 Mar 88.

Keywords: *Organic azides, *Emission spectra, Photoresistors, Excitation, Absorption spectra, Reprints, *Cyclohexanone/bis(azidobenzilidene)-ethyl, Energy level transitions.

The emission spectra of an initiator typical of those used in negative photoresists, namely 2,6 bis-(p-azidobenzilidene)-4-ethylcyclohexanone, were investigated. It is shown that the assumption that the large absorption band in negative photoresist is due to a single transition state is not valid. It is composed of narrow states which, in turn, implies that reciprocity failure and loss of sensitivity would occur at lower intensities than predicted. It is concluded that rapid quenching from the excited states is occurring.

800,433

PB89-123202 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Enskog Theory for Multicomponent Mixtures. 4. Thermal Diffusion.
Final rept., J. M. Kincaid, E. G. D. Cohen, and M. Lopez de Haro. 1987, 13p. See also PB86-195526. Pub. in Jnl. of Chemical Physics 86, n2 p963-975 1987.

Keywords: *Thermal diffusion, Mixtures, Fluids, Spheres, Reprints, *Chapman-Enskog theory.

Using the Revised Enskog theory, the authors derive equations for the thermal diffusion ratios, (k sub Ti), and thermal diffusion factors, (alpha sub ij), of multicomponent hard-sphere mixtures for systems in mechanical equilibrium. The first ten Enskog approximations to the thermal diffusion factor, (alpha sub ij)(N) (N = 1,2,...,10), are evaluated numerically for a variety of system parameter choices appropriate to binary and ternary mixtures. It is found that the first Enskog approximation does not vanish; the sequence of Enskog approximations converges most rapidly when the mass of the spheres are nearly equal. The seventh Enskog approximation was estimated to lie within about 1% of the exact value for all choices of system parameters. A comprehensive numerical study of the properties of the thermal diffusion factor for binary mixtures is given, including special mixtures such as the dusty gas, the Lorentz, quasi-Lorentz and Rayleigh gases and isotopic mixtures.

800,434

PB89-123228 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Characterization of Potential Thermal Degradation Products from the Reactions of Aqueous Ethylene Glycol or Propylene Glycol Solutions with Copper Metal.
Final rept., P. W. Brown, K. Galuk, and W. Rossiter. 1987, 5p. Sponsored by Department of Energy, Washington, DC. Pub. in Solar Energy Materials 16, n4 p309-313 1987.

Keywords: *Thermal degradation, *Ethylene glycol, *Copper, Inorganic salts, Infrared spectroscopy, X-ray diffraction, Reprints, *Propylene glycol, *Solar collectors, Heat transfer fluids.

Infrared spectra and x-ray diffraction peak spacing and intensities are presented for copper (II) salts of organic acids which may be generated as the result of the degradation of ethylene or propylene glycol solutions when used as heat transfer liquids in solar energy collection systems.

800,435

PB89-123665 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Excitation and Breakdown of Ar at Very High Ratios of Electric Field to Gas Density.
Final rept., A. V. Phelps, and B. M. Jelenkovic. 1988, 16p. Pub. in Physical Review A 38, n6 p2975-2990, 15 Sep 88.

CHEMISTRY

Physical & Theoretical Chemistry

Keywords: *Argon, *Atomic energy levels, *Electric fields, Mathematical models, Ionization, Excitation, Backscattering, Reprints.

Spatial distributions of 811-nm emission from the 2p(sub 9) and 2p(sub 7) (Paschen notation) levels of Ar have been measured for electrical discharges in Ar at very high ratios of electric field to gas density (E/n) and low nd , where d is the electrode separation. A model which includes Ar excitation and ionization by Ar(sup + 10 and by fast Ar(10-200 eV) is developed to explain the observations. The estimated ionization by electrons backscattered from the anode provides sufficient feedback to explain much of the electrical-breakdown data and our discharge-maintenance data. Other breakdown data require either a large yield of ionization by backscattered electrons or a very large ion-induced electron yield at the cathode.

800,436

PB89-123673

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

High-Resolution Infrared Spectroscopy of Weakly Bound Molecular Complexes.

Final rept.,

D. J. Nesbitt. 1988, 28p

Grants NSF-CHE86-05970, NSF-PHY86-04504

Sponsored by National Science Foundation, Washington, DC.

Pub. in Chemical Reviews 88, n6 p843-870 1988.

Keywords: *Infrared spectroscopy, *Complex compounds, Reviews, Chemical bonds, Reprints.

The author reviews and discusses work reported to date on high resolution infrared spectroscopy of weakly bound molecular complexes. A bibliography of 232 entries is included.

800,437

PB89-123715

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Collisional Energy Pooling for $Sr((5 \text{ sup } 3)(P \text{ sub } J)) + Sr((5 \text{ sup } 3)(P \text{ sub } J)) \rightarrow Sr((6 \text{ sup } 3,1)S) + Sr((5 \text{ sup } 1)S)$.

Final rept.,

J. F. Kelly, M. Harris, and A. Gallagher. 1988, 5p

Grant AFOSR-84-0282

Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and National Science Foundation, Washington, DC.

Pub. in Physical Review A 38, n3 p1225-1229, 1 Aug 88.

Keywords: *Strontium, *Molecular energy levels, Reaction kinetics, Excitation, Vapor phases., *Molecule-molecule collisions, *Energy pooling.

Energy pooling (EP) has been observed in Sr vapor following pulsed optical excitation to the 5 (sup 3)P(sub 1) state. From the time-dependent radiative decay of 6 (sup 1)S(sub 0) via the cascade resonance line, the EP rate coefficients have been investigated.

800,438

PB89-123723

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Innovative Laser Techniques in Chemical Kinetics: A Pedagogical Survey.

Final rept.,

L. J. Kovalenko, and S. R. Leone. 1988, 7p

Pub. in Jnl. of Chemical Education 65, n8 p681-687 Aug 88.

Keywords: *Reaction kinetics, *Lasers, *Education, Photochemical reactions, Dissociation, Chain reactions, Reprints.

A discussion of the use of lasers in chemical kinetics is presented at a level for high school instructors. The operation of lasers is described and a review of important principles in physical chemistry and kinetics is given. Several examples of modern research problems using lasers are treated in detail.

800,439

PB89-123806

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Rotational and State-Resolved Translational Distributions of NO Scattered from Organized Amphiphilic Monolayers.

Final rept.,

S. Cohen, R. Naaman, and J. Sagiv. 1988, 7p

Pub. in Jnl. of Chemical Physics 88, n4 p2757-2763, 15 Feb 88.

Keywords: *Nitrogen oxide(NO), *Aliphatic compounds, Scattering, Reprints, *Surface reactions, Rotational states, Vibrational states, Multi-photon processes, Photoionization, Molecular collisions.

Two-photon ionization has been used to probe nitrogen oxide (NO) scattered from two different long chain organic amphiphiles. Rotational and state-resolved translational distributions were obtained. The results show that there is a large difference in the dynamics of scattering from an unsubstituted aliphatic chain as compared to a monolayer in which the exposed end has been perfluorinated. NO scattered from the latter is more energetic both rotationally, and translationally. This effect becomes particularly noticeable as the incident energy of the NO is raised. The results can be explained by a mechanism which ignores the weak NO-surface potential and treats only the differences in rigidity and photon modes in the two monolayers.

800,440

PB89-123814

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

RKR-Based Inversion of Rotational Progressions.

Final rept.,

M. S. Child, and D. J. Nesbitt. 1988, 7p

Grants NSF-CHE86-05970, NSF-PHY86-04504

Sponsored by National Science Foundation, Washington, DC.

Pub. in Chemical Physics Letters 149, n4 p404-410, 26 Aug 88.

Keywords: Hydrogen, Reprints, *Intermolecular potentials, Rydberg-Klein-Rees method, Rotational states, Van der Waals forces.

A new RKR-based method is described for extracting intermolecular potentials via inversion of rotational energy levels deduced from a single vibrational band. Tests on a model van der Waals system and on the μ -0 rotational levels of H₂ Cl (sup 1 Sigma sub g) prove remarkably successful.

800,441

PB89-123822

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Photofragmentation of Acetone at 193 nm: Rotational- and Vibrational-State Distributions of the CO Fragment by Time-Resolved FTIR Emission Spectroscopy.

Final rept.,

E. L. Woodbridge, T. R. Fletcher, and S. R. Leone.

1988, 7p

Grants NSF-CHE84-08403, NSF-PHY86-04504

Sponsored by National Science Foundation, Washington, DC.

Pub. in Jnl. of Physical Chemistry 92, n19 p5387-5393 1988.

Keywords: *Acetone, *Dissociation, *Photochemical reactions, *Carbon monoxide, *Molecular rotation, *Molecular vibration, Infrared spectroscopy, Mathematical models, Reprints, *Fourier transform spectroscopy, Chemical reaction mechanisms, Methyl radicals.

Photofragmentation of acetone at 193 nm is known to produce predominantly two methyl radicals and a CO molecule. Infrared emission is collected from the CO fragment at time delays of 6-30 microseconds after the exciting laser pulse by a time-resolved Fourier transform spectrometer. High-resolution vibration-rotation spectra are obtained both under collision-free and rotationally relaxed conditions. Both the vibrational and rotational distribution can be successfully modeled by using a 'pure impulsive' mechanism for the fragmentation of an initial bent acetyl fragment. Thus, the observed distribution supports previous arguments that the dissociation occurs by a two-step fragmentation mechanism following single-photon excitation.

800,442

PB89-123830

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Quenching and Excitation Transfer for the $c(3 \text{ sup } 1)(\text{sub } u^-)$ and $a(3 \text{ sup } 1)(\text{sub } g^+)$ States of H₂ in Collisions with H₂.

Final rept.

A. B. Wedding, and A. V. Phelps. 1988, 10p

Sponsored by Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH., and National Science Foundation, Washington, DC.

Pub. in Jnl. of Chemical Physics 89, n5 p2965-2974, 1 Sep 88.

Keywords: *Hydrogen, *Metastable state, Excitation, Molecular vibration, Molecular rotation, Reprints, *Molecule-molecule collisions, Quenching.

Collisional destruction rate coefficients for $c(3 \text{ sup } 1)(\text{sub } u^-)$ metastable states by thermal energy hydrogen molecules have been measured for various vibrational and rotational levels ($N = 1$, $n_u = 0, 1, 2, 3$ and $n_v = 1, 2, 3$). The rate coefficients were found to be independent of vibrational and rotational quantum number and had a mean value of $(1.88 \pm 0.10) \times 10^{-10}$ to the -15th power cm^3/s at 300K.

800,443

PB89-123897

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Amine Phase Partitioning Using Emulsion Liquid Membranes.

Final rept.,

A. Kirkkopru, R. D. Noble, and A. L. Bunge. 1988, 9p

Pub. in Chemical Engineering Communications 64, p207-215 1988.

Keywords: *Solvent extraction, *Amines, Membranes, Thermodynamic equilibrium, Surface chemistry, Separation, Reprints, *Emulsion liquid membranes.

The bulk phase solute partitions coefficient ($K_{\text{sub mb}}$) is an important parameter in the modeling studies of emulsion liquid membrane (ELM) extraction systems, since it gives the ratio of solute concentration in the membrane phase to the solute concentration in the bulk phase at equilibrium. The partitioning of aromatic amines (aniline, p-toluidine, m-toluidine, and 4-chloroaniline) in water-oil-water type ELM systems has been studied experimentally as a function of internal phase volume fraction in the emulsion. Because aqueous aromatic amine solutions (AAASs) are known to photooxidatively decompose under the effect of light, mixing, and aeration which are present in the partitioning experiments conducted in this study, the amount of decrease in the bulk phase amine concentration due to photooxidation needs to be determined. The magnitude of the surface area between the internal phase and membrane phase was found to have no effect on the partitioning of the aromatic amines for the ELM systems studied here.

800,444

PB89-123905

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Thermodynamics of Ammonium Indates. 1. The Heat Capacity of the Ammonium Pentachloroindate Monohydrate Salt $(\text{NH}_4)_2 \text{Cl}_5\text{H}_2\text{O}$ from 8.5 to 349 K.

Final rept.,

R. J. C. Brown, J. E. Callanan, R. D. Weir, and E. F. Westrum. 1988, 7p

Pub. in Jnl. of Chemical Thermodynamics 20, p847-853 1988.

Keywords: *Specific heat, Thermodynamic properties, Reprints, *Ammonium pentachloroindate.

The heat capacity of ammonium pentachloroindate monohydrate $(\text{NH}_4)_2 \text{Cl}_5\text{H}_2\text{O}$ was measured from 8.5 to 349 K using adiabatic calorimetry. The curve of molar heat capacity against temperature is continuous, but exhibits a small anomaly at $110 < T/\text{K} < 130$. Values of the standard molar thermodynamic quantities for $(\text{NH}_4)_2 \text{Cl}_5\text{H}_2\text{O}$ are presented up to 345 K.

800,445

PB89-123913

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Thermodynamics of the Divalent Metal Fluorides. 1. Heat Capacity of Lead Tetrafluorostannate, PbSnF₄, from 10.3 to 352 K.

Final rept.,
J. E. Callanan, R. D. Weir, and E. F. Westrum. 1988, 4p
Sponsored by Department of National Defence, Ottawa (Ontario).
Pub. in Canadian Jnl. of Chemistry 66, p549-552 1988.

Keywords: *Specific heat, Thermodynamic properties, Lead inorganic compounds, Reprints, *Lead tin tetrafluoride.

The authors have measured the heat capacity of the fast ion conductor PbSnF₄ at 10.3 < T < 352 K by adiabatic calorimetry. Their results show anomalous values in the C_{sub p,m} in the region 300 < T < 352 K. These are associated with the alpha-beta crystallographic transition reported at 353 K. Because the upper temperature limit of our cryostat is around 354 K, it was impossible to follow the phase transition to completion. A more subtle anomaly in the C_{sub p,m} was detected between 130 and 160 K. Standard molar thermodynamic functions are presented at selected temperatures from 5 to 350 K.

800,446

PB89-123921 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Halogenated Alkylperoxyl Radicals as Oxidants: Effects of Solvents and of Substituents on Rates of Electron Transfer.

Final rept.,
Z. B. Alfassi, S. Mosseri, and P. Neta. 1987, 3p
Pub. in Jnl. of Physical Chemistry 91, n12 p3383-3385 1987.

Keywords: *Reaction kinetics, *Oxidizers, *Solvent action, *Electron transfer, *Halogen organic compounds, Radiolysis, Oxidation, Dielectric properties, Reprints.

The peroxyl radicals CCl₃O₂, CHCl₂O₂, CH₂ClO₂, CCl₃CClO₂, CCl₂ClO₂, CH₃CClO₂, CF₃CHClO₂, and CBr₃O₂ were produced by pulse radiolysis of aerated solutions of the appropriate halogen compound in 2-propanol or 2-propanol-water solutions. Rate constants for one-electron oxidation of chlorpromazine by these radicals were determined by kinetic spectrophotometry in various solvent mixtures. They depend very strongly on the solvent polarity and a reasonable correlation is obtained between log k for a certain peroxyl radical and the dielectric constant of the solvent mixture. The rate constants in the same solvent are strongly dependent on the substituents on the methylperoxyl radical and give a good correlation with the polar substituent constants G⁺.

800,447

PB89-123939 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Substituent Effects on Rates of One-Electron Oxidation of Phenols by the Radicals ClO₂, NO₂, and SO(3-).

Final rept.,
Z. B. Alfassi, R. E. Huie, and P. Neta. 1986, 3p
Pub. in Jnl. of Physical Chemistry 90, n17 p4156-4158 1986.

Keywords: *Reaction kinetics, *Oxidation, *Phenols, Chlorine oxides, Nitrogen oxides, Sulfur oxides, Radiolysis, Reprints, *Free radicals.

Rate constants for the reactions of ClO₂, NO₂, and SO₃⁻ radicals with several substituted phenoxide ions have been measured by pulse radiolysis. They vary from the immeasurably slow (less than 10 to the 4th power) to almost diffusion-controlled rates (greater than 10 to the 9th power/Ms) and depend on the redox potentials of the phenoxide ions and the inorganic radicals. With the weak oxidant SO₃⁻ reverse reactions were observed in certain cases, i.e., the phenoxyl radical oxidizes sulfite ions. An attempt is made to correlate the rate constants with Hammett's substituent constants.

800,448

PB89-123947 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Rates and Mechanisms of Oxidation of ZnTPP by CCl₃O₂ Radicals in Various Solvents.

Final rept.,
Z. B. Alfassi, A. Harriman, S. Mosseri, and P. Neta. 1986, 7p
Pub. in International Jnl. of Chemical Kinetics 18, n12 p1315-1321 1986.

Keywords: *Reaction kinetics, Oxidation, Radiolysis, Solvent action, Porphyrins, Reprints, *Chemical reaction mechanisms, *Zinc porphyrin, Free radicals, Peroxyl radicals.

Trichloromethylperoxyl radicals were produced by pulse radiolysis of air saturated solutions containing Cl₄. The rate constants for the reaction of CCl₃O₂ radicals with zinc tetraphenylporphyrin (ZnTPP) were determined in various solvents. They were found to vary between 3x10 to the 7th power and 3x10 to the 9th power/Ms. The changes in rate constants result from complexation of ZnTPP with the different solvents. However, they did not correspond to changes in redox potential of ZnTPP. The rate constants were found to depend on the strength of the axial complexation, indicating an inner sphere mechanism whereby the radical binds to the metal prior to electron transfer.

800,449

PB89-123954 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Redox Potential of the Azide/Azidyl Couple.

Final rept.,
Z. B. Alfassi, A. Harriman, R. E. Huie, S. Mosseri, and P. Neta. 1987, 3p
Pub. in Jnl. of Physical Chemistry 91, n8 p2120-2122 1987.

Keywords: *Oxidation reduction reactions, *Inorganic azides, *Reaction kinetics, *Potential energy, Radiolysis, Electron transfer, Iodides, Bromides, Thiocyanates, Reprints.

Pulse radiolysis experiments were carried out with neutral aqueous solutions containing azide with iodide, bromide, or thiocyanate to examine possible one-electron transfer rates and equilibria involving the N₃/N₃⁻ couple. Cyclic voltammetry experiments with N₃⁻ showed a single peak on the anodic scan and no peak on the cathodic scan due to the rapid decay of the N₃ radicals. From the dependence of peak potential on scan rate E_{sub 1/2} for the N₃/N₃⁻ couple (1.32 ± 0.03) V vs. NHE is derived.

800,450

PB89-123962 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Redox Chemistry of Gold(III) Porphyrins in Water.

Final rept.,
Z. Abou-Gamra, A. Harriman, and P. Neta. 1986, 14p
Pub. in Jnl. of the Chemical Society, Faraday Transactions 2 82, n12 p2337-2350 1986.

Keywords: *Oxidation reduction reactions, Porphyrins, Anions, Catalysts, Reaction kinetics, Water, pH, Radiolysis, Reprints, *Gold porphyrins.

Gold(III) porphyrins are easily reduced to the corresponding radical anions, which are stable in water over a wide pH range. Further reduction results in formation of the phlorins with relatively little tendency to form chlorins. Both radical anion and phlorin will reduce water to H₂ on the surface of a colloidal Pt catalyst. From kinetic studies, it is seen that the radical anion is by far the better reducing species. Using NADH as reducing agent, a photosystem has been devised which results in the overall storage of visible light. Oxidation of the gold(III) porphyrins results in destruction of the porphyrin ring.

800,451

PB89-124028 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Short-Range Order and Frustration in Omphacite: Comparison of Three CVM (Cluster Variation Method) Approximations.

Final rept.,
B. P. Burton, and P. M. Davidson. 1988, 9p
Pub. in Physics and Chemistry of Minerals 15, p570-578 1988.

Keywords: *Silicon oxides, *Crystal structure, *Mathematical models, Comparisons, Reprints, *Cluster variation method, *Omphacite.

The authors compare three cluster variation method (CVM) models for order-disorder in omphacite (Al_{0.5}Mg_{0.5}(Na_{0.5}Ca_{0.5})Si₂O₆): the generalized point approximation (GPA), generalized pair approximation (GPAA) and an approximation that is based on two eight-body clusters (2X8A). The same Hamiltonian (set of pairwise interactions) is used for all three approximations. Pair probabilities predicted by the GPA obey the geometric constraints of the crystal structure (the frustration constraint), but the exclusion of short-range order (SRO) leads to overestimates of the configurational internal energy (E), and the critical temperature for cation order-disorder (T_(sub C)).

800,452

PB89-124044 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.

Quasiperiodic Crystals: A Revolution in Crystallography.

Final rept.,
J. W. Cahn. 1986, 6p
Pub. in MRS Bulletin 11, n2 p9-14 1986.

Keywords: *Crystallography, Reprints, Quasicrystals.

The 1985 Von Hippel prize lecture was recorded and transcribed for publication in the membership bulletin. The author covered some aspects of the current state of quasicrystals.

800,453

PB89-124820 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

High Efficiency Soft X-ray Emission Spectrometer for Use with Synchrotron Radiation Excitation.

Final rept.,
T. A. Callcott, K. L. Tsang, C. H. Zhang, D. L. Ederer, and E. T. Arakawa. 1986, 11p
Pub. in Review of Scientific Instruments 57, n11 p2680-2690 Nov 86.

Keywords: *X-ray spectrometers, *Laboratory equipment, *Emission spectroscopy, *Synchrotron radiation, Design criteria, Performance evaluation, Aluminum, Silicon, Lithium fluorides, Photons, Excitation, Reprints.

A new soft x-ray spectrometer designed for use with photon excitation from synchrotron light sources is described and characterized. Special design features, including a close spaced input slit, large toroidal gratings, and a two dimensional Si-diode based detector system provide exceptional measuring efficiency in a five meter Rowland circle design, and of calibration and alignment procedures. The beam line providing photon excitation from a synchrotron light source is described. Typical electron beam and/or photon excited emission spectra of Al, Si, and LiF are presented and compared with those produced by other instruments.

800,454

PB89-124838 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Topochemical Li-Ion Insertion into FeClMoO₄ and Fe₂(MoO₄)₃: Structure and Magnetism of LiFeClMoO₄ and Li₂Fe₂(MoO₄)₃.

Final rept.,
C. C. Torardi, W. M. Reiff, J. H. Zhang, and E. Prince. 1988, 6p
Pub. in Materials Science Forum 27/28, p223-228 1988.

Keywords: *Crystal structure, *Neutron diffraction, Iron inorganic compounds, Magnetic properties, Hyperfine structure, Reprints, *Iron chlorine molybdates, *Iron molybdates, *Lithium ions, Chemical reaction mechanisms, Rietveld method.

The layered compound FeClMoO₄ and the open framework compound Fe₂(MoO₄)₃ undergo reversible Li ion insertion by stirring the solid in an acetonitrile solution of LiI. Reaction occurs via a topochemical redox-insertion mechanism. The structures were determined by Rietveld profile analysis of neutron powder diffraction data. The structure of LiFeClMoO₄ is essentially the same as that of the precursor and contains Li ions in distorted octahedral sites between the FeClMoO₄ layers. Magnetic hyperfine splitting of the zero field Mossbauer spectrum below 12.5 K indicates a three-dimensional magnetically ordered state which susceptibility results show to be weakly ferro-

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magnetic due to probable canting of antiferromagnetically coupled spins. Refinement of the magnetic structure from low temperature neutron powder diffraction data shows the spins on iron to be oriented parallel with the b axis and antiferromagnetically coupled.

800,455

PB89-124853

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Thermophysics Div.

Hydrogen Component Fugacities in Binary Mixtures with Ethane: Temperature Dependence.

Final rept.,

T. J. Bruno, and J. A. Schroeder. 1987, 11p
Pub. in International Jnl. of Thermophysics 8, n4 p437-447 1987.

Keywords: *Fugacity, *Hydrogen, *Binary systems(Materials), Ethane, Test chambers, Membranes, Comparisons, Reprints.

The fugacity coefficients of hydrogen in binary mixtures with ethane were measured using a physical equilibrium technique. This technique involves the use of an experimental chamber which is divided into two regions by a semipermeable membrane through which hydrogen, but not ethane can penetrate. Measurement of the gas pressures inside and outside of the membrane allows a direct measurement of the hydrogen component fugacity coefficient at a given temperature and binary mixture mole fraction. The qualitative features of the measurements are discussed, and comparisons are made with predictions obtained from the Redlich-Kwong, Peng-Robinson, and extended corresponding states models.

800,456

PB89-124887

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Q-Branch Line Mixing in N₂O: Effects of 1-Type Doubling.

Final rept.,

L. L. Strow, and A. S. Pine. 1988, 8p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics 89, n3 p1427-1434, 1 Aug 88.

Keywords: *Nitrous oxide, *Molecular energy levels, *Molecular rotation, Line spectra, Line width, Spectrum analysis, Reprints, *Line mixing, Line broadening.

Rotational collisional narrowing, or line mixing, has been observed in the O branch of the $\nu_2 + \nu_3$ P1-Sigma band of N₂O near 2798/cm using a difference-frequency spectrometer. Self-broadened spectra were recorded at pressures ranging from 20 to 747 Torr. The broadening coefficients, derived from the lower pressures before the lines significantly overlap, are in close agreement with prior measurements of P- and R-branch widths in Sigma-Sigma bands. At higher pressures where the O-branch lines are blended, the band contours deviate from purely additive component line shapes, exhibiting stronger peak absorptions and weaker wings characteristic of line mixing. A simple rotational energy gap scaling law is used to model the off-diagonal relaxation matrix elements needed to calculate the observed collisional narrowing. Spectra calculated using several trial sets of collisional selection rules are presented, as is evidence for a parity conserving collisional selection rule and/or elastic-reorientation collisions.

800,457

PB89-124895

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Molecular Beam Spectrum of the Highly Perturbed C-H Stretching Region of Fluoroform.

Final rept.,

A. S. Pine, G. T. Fraser, and J. M. Pliva. 1988, 9p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics 89, n6 p2720-2728, 1 Sep 88.

Keywords: *Molecular spectroscopy, *Doppler effect, Fluorine organic compounds, Perturbations, Molecular relaxation, Reprints, *Methane/trifluoro, Fluoroform.

Assignments of the C-H stretching fundamental of fluoroform, CHF₃ have been obtained from a spectrum recorded near 3035/cm at sub-Doppler resolution approximately 10 MHz (FWHM) and low effective temperature (approximately 4K) in an adiabatically cooled

molecular beam using bolometric detection of molecules excited by a color-center laser. This fundamental band is highly perturbed and has resisted analysis at higher temperatures, even at Doppler-limited resolution, whereas its overtones have been the subject of several studies of intramolecular vibrational relaxation. Under molecular beam conditions, the central Q branch, which dominates the spectrum at room temperature, almost vanishes, while the bulk of the intensity is equally shared by two 'sidebands' with O branches symmetrically displaced by approximately + or - 5 cm from the suppressed central O branch.

800,458

PB89-124903

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Rydberg-Like Properties of Rotational-Vibrational Levels and Dissociation Continuum Associated with Alkali-Halide Charge-Transfer States.

Final rept.,

S. H. Pan, and F. H. Mies. 1988, 8p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 89, n5 p3096-3103, 1 Sep 88.

Keywords: *Halogen organic compounds, *Molecular vibration, *Molecular rotation, Eigenvalues, Elastic scattering, Deformation, Reprints, *Charge transport, *Charge state, *Rydberg states.

Fully quantal calculations for the vibrational bound levels and adjoining continuum of alkali-halide charge-transfer states have been made using new algorithms derived from the Milne quantum number function for the radial motion of the diatom. Because of the asymptotic Coulombic interaction, the molecular potential actually supports an infinite number of bound vibrational states which conform to a Rydberg-like spectrum and can be characterized by a vibrational quantum defect. As predicted by conventional quantum defect theory for perturbed Rydberg series the vibrational quantum defect extrapolates across the dissociation limit to yield the threshold elastic scattering phase shift for the dissociative continuum state. The implicit dependence of the defect on the rotational state of the molecule yields a complete description of the rotational-vibrational spectrum. Because the system is heavy, the mass and rotational dependence of the computed quantum defects generally conform to appropriate WKB-like predictions. The usefulness of the numerical results in forthcoming investigations of two body collisional charge-transfer processes is also indicated.

800,459

PB89-124911

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Co-adsorption of Water and Oxygen on Ag(110): A Study of the Interactions Among H₂O, OH, and O. Summary Abstract.

Final rept.,

K. Bange, T. E. Madey, J. K. Sass, and E. M. Stuve. 1987, 2p
Pub. in Jnl. of Vacuum Science and Technology A 5, n4 pt1 p954-955 Jul/Aug 87.

Keywords: *Adsorption, *Water, *Oxygen, *Silver, *Surface chemistry, Chemisorption, Spectrum analysis, Mathematical models, Reprints, Hydroxyl radicals.

Knowledge of the reactions and interactions among H₂O, OH, and O on metal surfaces is important in understanding, for example, electrochemical oxygen reduction, corrosion, and catalytic oxidation reactions. Previous studies of H₂O and O coadsorbed on Ag(110) have shown that they react to form OH groups which are stable for temperatures up to approximately 300 K (4-8). In the report the authors discuss the results of electron stimulated desorption ion angular distribution (ESDIAD), low energy electron diffraction (LEED), and thermal desorption spectroscopy (TDS), performed as a function of coverage and annealing temperature, which show more details of H₂O-OH-O surface chemistry than previously available. In particular, they focus on descriptions of the structure of OH groups on this surface and a model for interacting H₂O and OH which is called the gamma-H₂O adsorption state.

800,460

PB89-124952

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Measurement of the Gamma-Ray Emission Rate of (109)Cd with a Well-Type NaI(Tl) Detector.

Final rept.,

C. Ballaux, and J. M. R. Hutchinson. 1986, 6p
Pub. in Applied Radiation and Isotopes 37, n9 p923-928 1986.

Keywords: *Spectrum analysis, *Gamma ray spectroscopy, Compton effect, Numerical analysis, Reprints, *Cadmium 109.

The gamma-ray emission rate of (109) Cd can be measured by means of spectrometry with a NaI(Tl) well-type detector. The corrections for photoelectron escape, from bremsstrahlung produced during slowing-down in NaI(Tl) and by the conversion electrons, and from other minor effects have been calculated.

800,461

PB89-126007

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Kinetics of One-Electron Oxidation by the Cyanate Radical.

Final rept.,

Z. B. Alfassi, R. E. Huie, S. Mosseri, and P. Neta. 1987, 4p
Pub. in Jnl. of Physical Chemistry 91, n14 p3888-3891 1987.

Keywords: *Reaction kinetics, *Oxidation, *Cyanates, Molecular structure, Radiolysis, Free radicals, Reprints, *Chemical reaction mechanisms, *Cyanate radicals.

The reaction of cyanate ions with hydroxyl radicals was studied by pulse radiolysis and found to lead to formation of a transient absorbing at 330 nm ($\epsilon = 0.70/\text{M cm}$). The rate of formation of this transient is slower than the rate of reaction of NCO(sup -1) with OH, in agreement with previous results. This indicates that the initial OH adduct, which is known to rearrange to NHCO₂(sub -1), reacts with another NCO(sub -1) to form the observed transient. Comparing these rate constants with those for other oxidizing radicals and taking into consideration the redox potentials of the radicals and the substrates, it is concluded that the cyanate radical has a redox potential of about 0.6-0.7 V vs NHE. Such a weak oxidant cannot be ascribed the structure (NCO)₂(sup -1) and the alternative structure ((sup -1)O₂CNHNCO(sup -1)) is suggested.

800,462

PB89-126361

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.

Evaluation of the Triple Point of 1,3-Dioxolan-2-One.

Final rept.,

J. D. Cox, and B. W. Mangum. 1987, 6p
Pub. in Metrologia 23, n4 p173-178 1987.

Keywords: *Critical point, Phase transformations, Reprints, *Dioxolanone, *Reference materials, *Triple point.

The temperature characteristics of the same two glass triple-point cells containing well purified samples of 1,3-dioxolan-2-one have been studied at NPL and NBS. Triple-point temperatures measured on 'mushes' under near-equilibrium conditions were found to be more reproducible than those measured during continuous cooling or heating through the phase transition. The results from the mush experiments, using measurements taken with a variety of standard platinum resistance thermometers, proved that realizations of IPTS-68 in the two national laboratories agree to within 0.3 mK at 36 C, in accord with the expectations of the Comité Consultatif de Thermometrie. After being corrected for the effect of residual impurities in the sample and of the hydrostatic head, the mean value of the triple-point temperature of the substance is 36.3238 C, with an overall uncertainty of 0.0004 C.

800,463

PB89-126429

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.

Critical Lines for a Generalized Three State Binary Gas-Liquid Lattice Model.

Final rept.,

P. H. E. Meijer, M. Keskin, and I. L. Pegg. 1988, 7p
Pub. in Jnl. of Chemical Physics 88, n3 1976-1982, 1 Feb 88.

Keywords: *Binary systems(Materials), *Mathematical models, *Critical field, *Gas-liquid ratio, Thermodynamic properties, Van der Waals equation, Polymers, Reprints.

The critical properties of several compressible binary gas-liquid models are described: the three state lattice gas, the Tompa model for polymer solutions, the van der Waals equation for binary mixtures, and an intermediate model. The critical lines are expressed as functions of $x(\text{sub } 1)$ and $x(\text{sub } 2)$, the density of type 1 molecules and the density of type 2 molecules, instead of using the pressure and temperature; representative figures are given for each of the models. The general conditions for criticality, stability, and tricriticality are given as functions of $x(\text{sub } 1)$ and $x(\text{sub } 2)$ through the intermediary of the spinodal temperature function $T(x(\text{sub } 1), x(\text{sub } 2))$. A closed form solution is given for the Berthelot case (geometrical-mean combining rule). All the models exhibit a characteristic intersection of two critical lines, and the behavior near this point is investigated. In the van der Waals case the coordinates given by van Laar are confirmed.

800,464

PB89-126817

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.

Measurements of the Viscosities of Compressed Fluid and Liquid Carbon Dioxide + Ethane Mixtures.

Final rept.,

D. E. Diller, L. J. Van Poolen, and F. V. Santos.

1988, 5p

Sponsored by Gas Research Inst., Chicago, IL.

Pub. in Jnl. of Chemical and Engineering Data 33, n4 p460-464 1988.

Keywords: *Viscosity, *Compressibility, *Liquefied gases, *Piezoelectricity, Shear tests, Carbon dioxide, Ethane, Mixtures, Low temperature tests, High pressure tests, Measuring instruments, Reprints.

The shear viscosity coefficients of three compressed gaseous and liquid carbon dioxide/ethane mixtures have been measured with a torsional piezoelectric crystal viscometer at temperatures between 210 and 320 K and at pressures to about 30 MPa (4350 psi). The experimental error is estimated to be smaller than 3% in most cases. The measurements have been compared with an extended corresponding states model, and used to examine the dependences of the fluidities (viscosity sub minus 1) on specific volume, composition and temperature.

800,465

PB89-126866

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Behavior of Dilute Mixtures Near the Solvent's Critical Point.

Final rept.,

R. F. Chang, and J. M. H. Levelt Sengers. 1986, 7p

Pub. in Jnl. of Physical Chemistry 90, n22 p5921-5927, 23 Oct 86.

Keywords: *Critical point, *Solvents, *Dilution, *Mixtures, Thermodynamic properties, Enthalpy, Specific heat, Osmosis, Mathematical models, Reprints, Leung-Griffiths model.

In the limit of infinite dilution at the critical point of the solvent many thermodynamic properties such as excess properties and partial molar quantities exhibit remarkable anomalies. A striking effect is that finite properties such as the partial molar volume of the solvent exhibit dependence on the path of approach to the critical point. Using the Leung-Griffiths model of mixtures the authors are able to calculate partial molar volume, partial molar enthalpy, osmotic susceptibility, isothermal compressibility at constant pressure and composition, partial molar heat capacity, osmotic coefficient and activity coefficient. The Leung-Griffiths thermodynamic potential is nonclassical and is of a scaled form. By the use of a model, the path-dependence of many of these properties is analyzed and their explicit x-dependence (where x is the mole fraction of the solute) is obtained as well as asymptotic expressions along various paths leading to the pure solvent's critical point.

800,466

PB89-126874

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Accurate Energy Levels for Singly Ionized Platinum. Part 2.

Final rept.,

J. Reader, N. Acquista, C. J. Sansonetti, and R.

Engleman. 1988, 13p

Contract NASA-S-14790-D

Sponsored by Department of Energy, Washington, DC, and National Aeronautics and Space Administration, Washington, DC.

Pub. in Jnl. of the Optical Society of America B 5, n10 p2106-2118 Oct 88.

Keywords: *Atomic energy levels, Ultraviolet spectroscopy, Wavelengths, Reprints, *Platinum ions, Fourier transform spectroscopy.

New observations of the spectrum of Pt II have been made with hollow-cathode lamps. The region from 1032 to 4101 Å was observed photographically with a 10.7-m normal-incidence spectrograph. The region from 2245 to 5223 Å was observed with a Fourier-transform spectrometer. Wavelength measurements were made for 558 lines. The uncertainties vary from 0.0005 to 0.444 Å. From these measurements and three parity-forbidden transitions in the infrared, accurate values were determined for 28 even and 72 odd energy levels of Pt II.

800,467

PB89-126890

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.

Surface Roughness Sensed by Ultrasound.

Final rept.,

G. V. Blessing, and D. G. Eitzen. 1988, 15p

Pub. in Surface Topography 1, p253-267 1988.

Keywords: *Surface roughness, *Metals, *Ultrasonic tests, Backscattering, Performance evaluation, Topography, Reprints.

Ultrasonic back-scattering amplitude measurements have been made on metal surfaces as a function of their roughness, using both air and liquid coupling techniques between sensor (transducer) and surface. The measurements were made on both static and rapidly moving surfaces. Pulsed ultrasonic waves ranging in frequency from 1-30 MHz were used, corresponding to wavelengths down to 50 micrometers in water. Most of the work used an area-averaging technique with an incident ultrasonic beam spot size much larger than the detailed topographical features of the surface. As a feasibility test for in-process application, a liquid squirt system, with an arcuate tubular extension for guiding pulses of ultrasound through the couplant stream to a part, was successfully tested on rotating surfaces moving in excess of 5 m/sec. Finally, by focusing the ultrasonic beam at high frequencies, a profilometry capability was demonstrated. The topography of a 1.1 micrometers R_(sup q) sinusoidal specimen was mapped both by amplitude and transit-time measurements using focused ultrasound at 30 MHz.

800,468

PB89-126940

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Dynamics of Dissociative Adsorption and Vibrational Excitation in Molecule-Surface Collisions.

Final rept.,

J. W. Gadzuk. 1987, 4p

Pub. in Jnl. of Vacuum Science and Technology A 5, n4 pt1 p492-495 1987.

Keywords: *Molecular beams, Diatomic molecules, Dissociation, Excitation, Adsorption, Reprints, *Molecular collisions, *Surface reactions, Vibrational states.

Collisions between diatomic molecular beams and solid surfaces are here simulated through classical trajectory calculations over model potential energy surfaces. Insights into the conditions responsible for dissociative adsorption vs. vibrationally excited scattering are provided.

800,469

PB89-126957

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Core Level Spectroscopy: A Dynamics Perspective.

Final rept.,

J. W. Gadzuk. 1987, 10p

Pub. in Physica Scripta 35, n2 p171-180 1987.

Keywords: *Dynamics, *Relaxation(Mechanics), *Solids, *Surface chemistry, Reprints, *Core level spectroscopy.

Various aspects of the dynamics of time-dependent localized potentials and interactions in solids and at surfaces, as they might relate to the fundamental screening and relaxation processes involved in core level spectroscopies, are explored.

800,470

PB89-127013

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Reply to Comment on 'Small-Angle Neutron Scattering Evidence for the Absence of Long-Range Magnetic Order in Amorphous Fe91 Zr9.'

Final rept.,

G. E. Fish, and J. J. Rhyne. 1987, 2p

Pub. in Jnl. of Applied Physics 61, n1 p454-455, 1 Jan 87.

Keywords: *Neutron scattering, *Ferromagnetic materials, *Zirconium alloys, *Iron containing alloys, Critical points, Reprints, *Small angle scattering, *Amorphous state.

Experimental evidence is presented and reviewed that amorphous Fe₉₁Zr₉ does not exhibit conventional long-range ordered ferromagnetism below its $T(\text{sub } c) = 210$ K, but rather enters a state characteristic of a strongly exchange frustrated system in which the ferromagnetic correlations are quite short range (less than 30 Å) as determined by small angle neutron scattering (SANS). At a lower temperature the SANS develops a Lorentzian-squared component to the line-shape which is evidence of cluster spin freezing. Inelastic scattering data show no resolvable spin wave peaks and place an upper limit of 12-15 meV-Å (sup 2) on the spin stiffness D. The anomalously small ratio of $D/T(\text{sub } c)$ is further evidence of a system near a multi-critical point concentration.

800,471

PB89-127021

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Structure of the Lithium Inserted Metal Oxide delta LiV2O5.

Final rept.,

R. J. Cava, A. Santoro, D. W. Murphy, S. M. Zahurak,

R. M. Fleming, P. Marsh, and R. S. Roth. 1986, 9p

Pub. in Jnl. of Solid State Chemistry 65, n1 p63-71, 1 Nov 86.

Keywords: *Molecular structure, *Neutron diffraction, *X-ray diffraction, Chemical bonds, Complex compounds, Reprints, *Lithium vanadium oxides.

Employing neutron and x-ray powder diffraction analysis the authors have found that the compound of composition LiV₂O₅ formed at ambient temperature on insertion of Li into V₂O₅ has a structure which is significantly distorted. The V₂O₅ host acts as a layered compound at high lithium contents: weak V-O bonds are broken and neighboring layers both shift and buckle to accommodate the inserted lithium ions.

800,472

PB89-127047

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.

Chemisorption and Rotational Epitaxy of Lithium on Ru(001).

Final rept.,

D. L. Doering, and S. Semancik. 1986, 7p

Pub. in Surface Science 175, n2 pL730-L736 Sep 86.

Keywords: *Chemisorption, *Lithium, *Surface chemistry, *Epitaxy, Crystal growth, Adsorption, Electron diffraction, Ruthenium, Reprints, *Rotational states, *Thermal desorption spectroscopy, *Low energy electron diffraction.

Rotational epitaxy of an overlayer along a nonsymmetry direction of the substrate has been observed as a mechanism for the accommodation of lattice mismatch in rigid thin films. In the study, the adsorption and rotational epitaxy of Li on the Ru(001) surface was examined using thermal desorption spectroscopy and low energy electron diffraction. At higher coverages, the Li layer orientation rotates relative to the substrate as the interatomic spacing of the layer is compressed. This behavior is qualitatively similar to that observed for Na on Ru(001), but differences were observed

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which may suggest that Li overlayers are less rigid than Na overlayers.

800,473

PB89-127088

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Reactions of Electronically Excited Vinylidene Radicals with Molecular O₂.

Final rept.,

A. Fahr, and A. Laufer. 1987, 4p

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in Jnl. of the American Chemical Society 109, n13 p3843-3846 1987.

Keywords: *Oxygen, *Reaction kinetics, Excitation, Reprints, *Vinylidene radicals, *Chemical reaction mechanisms.

The rate constant and mechanism for the reaction between electronically excited vinylidene and molecular oxygen has been examined at 297K. The vinylidene radicals were produced from the vacuum ultraviolet flash photolysis of vinyl chloride. Reactant triplet vinylidene and product CO and formaldehyde were observed, in real time, by their characteristic absorption in the vacuum ultraviolet region. The two products were formed in equal amounts and the reaction probably proceeds through a cyclic intermediate. The mechanism of the reaction of unsaturated hydrocarbon radicals with molecular O₂ is discussed.

800,474

PB89-127153

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.

Observation of Sharp Resonances in the Spontaneous Raman Spectrum of a Single Optically Levitated Microdroplet.

Final rept.,

T. R. Lettieri, and R. E. Preston. 1985, 4p

Pub. in Optics Communications 54, n6 p349-352, 15 Jul 85.

Keywords: *Raman spectra, *Drops(Liquids), Inelastic scattering, Light scattering, Aerosols, Reprints, Phthalic acid/(dioctyl-ester), Silicone oil.

Sharp resonances have been observed in the spontaneous Raman spectra of single, optically levitated microdroplets. The droplets, 10 to 35 micrometers in diameter, were suspended by a CW argon laser beam which also served as the Raman excitation source. Experiments with dioctyl phthalate (DOP) and silicone oil confirmed that all Raman bands present in the bulk liquid spectra were also observable in the levitated droplet spectra, in agreement with previous micro-Raman studies of droplets on substrates. However, superimposed on the spectra of the levitated droplets was a series of sharp features not present in the bulk liquid spectra. Time-resolved experiments with growing DOP droplets showed that the sharp Raman features have the same origin as the elastic light scattering and fluorescence resonances observed in previous studies of microspheres and fibers.

800,475

PB89-127203

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Measurements of CO($\nu=1$) Population Lifetimes: Metal-Carbonyl Cluster Compounds Supported on SiO₂.

Final rept.,

E. J. Heilweil, J. C. Stephenson, and R. R.

Cavanagh. 1988, 5p

Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.

Pub. in Jnl. of Physical Chemistry 92, n21 p6099-6103, 20 Oct 88.

Keywords: *Carbon monoxide, *Molecular relaxation, *Silicon dioxide, *Molecular vibration, *Complex compounds, Dynamics, Metal carbonyls, Energy transfer, Reprints.

Time-resolved measurements of the population relaxation lifetime ($T_{\text{sub 1}}$) of terminal CO($\nu=1$) stretching vibrations in a series of metal-carbonyl cluster compounds supported on SiO₂ are reported. When on SiO₂, the compounds exhibit $T_{\text{sub 1}}$ lifetimes which are all a factor of 4 shorter than the results for the same cluster compounds in room-temperature chloroform solution. This increase in rate suggests energy transfer to the Si-O stretch substrate modes occurs.

Energy transfer to vibrational or electronic states of the central metal core seems unimportant in determining $T_{\text{sub 1}}$ for these systems.

800,476

PB89-133425

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.

Remeasurement of a Silicon Lattice Period.

Final rept.,

R. D. Deslattes, M. Tanaka, G. L. Greene, A. Hening, and E. G. Kessler. 1987, 4p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p166-169 Jun 87.

Keywords: *Silicon, *Optical interferometers, *Lattice parameters, Performance evaluation, Reprints.

Optical interferometry of a Silicon lattice period is an important link between macroscopic and microscopic lengths as well as between low-energy and high-energy spectroscopies. An evident discrepancy between two pre-1982 measurements has limited the effective application of these results. Very recent results, reported here in a preliminary way, appear to further understanding and removing this discrepancy.

800,477

PB89-135685

Not available NTIS
American Chemical Society, Washington, DC.

Journal of Physical and Chemical Reference Data, Volume 17, Number 3, 1988.

Quarterly rept.

c1988, 413p

See also PB89-135693 through PB89-135719 and PB88-156435. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.

Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Reaction kinetics, *Oxidation reduction reactions, *Oxygen, Organic compounds, Inorganic compounds, Ionization, Solutions, Chemical radicals, Cross sections.

Contents: Evaluated chemical kinetic data for the reactions of atomic oxygen with saturated organic compounds in the gas phase; Rate constants for reactions of inorganic radicals in aqueous solution; Recommended data on the electron impact ionization of atoms and ions: Fluorine to nickel; and Cumulative listing of reprints and supplements.

800,478

PB89-135693

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Evaluated Chemical Kinetic Data for the Reactions of Atomic Oxygen O(3P) with Saturated Organic Compounds in the Gas Phase.

Quarterly rept.,

J. T. Herron. c1988, 59p

Included in Jnl. of Physical and Chemical Reference Data, v17, n3 p967-1026 1988. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Reaction kinetics, *Oxidation reduction reactions, Organic compounds, Inorganic compounds, Oxygen, Evaluation, Alkanes, Cycloalkane hydrocarbons, Haloalkanes, Free radicals, Alcohols, Aldehydes, Silanes.

Rate constants and mechanisms for the gas phase reactions of atomic oxygen with organic compounds having only saturated C-C bonds are compiled and critically evaluated. Data are given for the alkanes, cycloalkanes, haloalkanes, oxygen and nitrogen containing organic compounds, and free radicals. In addition, data are given for some miscellaneous compounds containing boron, silicon, germane, and mercury. From a critical examination of the data, recommended values for rate constants are given over specified temperature intervals or at specified temperatures. Error limits are assigned to all recommended values.

800,479

PB89-135701

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Rate Constants for Reactions of Inorganic Radicals in Aqueous Solution.

Quarterly rept.,

P. Neta, R. E. Huie, and A. B. Ross. c1988, 257p
Included in Jnl. of Physical and Chemical Reference Data, v17 n3 p1027-1284 1988. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Reaction kinetics, *Inorganic compounds, *Chemical radicals, Solution, Carbonates, Chlorides, Halogens, Nitrogen, Oxygen, Ozone, Phosphates, Sulfur, Phosphorus, Photolysis, Radiolysis.

Rate constants have been compiled for reactions of various inorganic radicals produced by radiolysis or photolysis, as well as by other chemical means, in aqueous solutions. Data are included for the reactions of CO₂(1-), CO₃(1-), O₃, N₃, NH₂, NO₂, PO₃(2-), PO₄(2-), SO₂(1-), SO₃(1-), SO₄(1-), SO₅(1-), SeO₃(1-), (SCN)₂(1-), Cl₂(1-), Br₂(1-), I₂(1-), ClO₂, BrO₂, and miscellaneous related radicals, with inorganic and organic compounds.

800,480

PB89-135719

Not available NTIS
Queen's Univ., Belfast (Northern Ireland).

Recommended Data on the Electron Impact Ionization of Atoms and Ions: Fluorine to Nickel.

Quarterly rept.,

M. A. Lennon, K. L. Bell, H. B. Gilbody, J. G. Hughes, A. E. Kingston, M. J. Murray, and F. J. Smith. c1988, 78p

Sponsored by National Bureau of Standards, Gaithersburg, MD.

Included in Jnl. of Physical and Chemical Reference Data, v17 n3 p1285-1363 1988. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Ionization, *Cross sections, Electron, Impact, Assessment, Graphs(Charts), Electron impact ionization.

Experimental and theoretical cross-section data for electron impact ionization of atoms and ions from fluorine to nickel has been assessed and earlier recommendations for light atoms and ions have been revised. Based on this assessment and, in the absence of any data, on the classical scaling laws a recommended cross section has been produced for each species. This has been used to evaluate recommended Maxwellian rate coefficients over a wide range of temperatures. Convenient analytic expressions have been obtained for the recommended cross sections and rate coefficients. The data are presented in both graphical and tabular form and estimates of the reliability of the recommended data are given.

800,481

PB89-135727

Not available NTIS
American Chemical Society, Washington, DC.

Journal of Physical and Chemical Reference Data, Volume 17, 1988, Supplement No. 1. Gas-Phase Ion and Neutral Thermochemistry.

Quarterly rept.,

S. G. Lias, J. E. Bartmess, J. F. Liebman, J. L. Holmes, R. D. Levin, and W. G. Mallard. c1988, 879p
ISBN-0-88318-562-8

See also Volume 17, Number 2, PB89-136337 and Number 3, PB89-135686. Library of Congress catalog card no. 88-70606. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Thermochemistry, Acidity, Anions, Alkalinity, Cations, Heat of formation, Chemical equilibrium, Ions, Molecules, Ionization potentials, Tables(Data), Electron affinity, Proton affinity.

Critically evaluated data on heats of formation of positive and negative ions in the gas phase are compiled and presented in these tables (GIANT tables), along with auxiliary information on ionization energies, proton affinities, electron affinities and acidities, as well as relevant thermochemistry of related neutral species. The literature coverage is through the middle of 1986. The criteria used in carrying out evaluations of data are described, and a short discussion is presented of special concerns for the thermochemistry of charged species. (Copyright (c) 1988 by the U.S. Secretary of Commerce on behalf of the United States.

The copyright will be assigned to the American Institute of Physics and the American Chemical Society.)

800,482

PB89-135735 Not available NTIS
American Chemical Society, Washington, DC.

Journal of Physical and Chemical Reference Data, Volume 17, 1988, Supplement No. 4. Atomic Transition Probabilities Iron through Nickel.

Quarterly rept.,
J. R. Fuhr, G. A. Martin, and W. L. Wiese. c1988, 511p ISBN-0-88318-586-5
See also Volume 17, Number 2, PB89-136337 and Number 3, PB89-135686. Library of Congress catalog card no. 88-72276. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Transition probabilities, *Iron, *Cobalt, *Nickel, Electron transitions, Atomic spectra, Oscillators, Spectral lines, Reprints.

Atomic transition probabilities for about 9,500 spectral lines of three iron-group elements, Fe ($Z = 26$) to Ni ($Z = 28$), are critically compiled, based on all available literature sources. The data are presented in separate tables for each element and stage of ionization and are further subdivided into allowed (i.e., electric dipole-E1) and forbidden (magnetic dipole-M1, electric quadrupole-E2, and magnetic quadrupole-M2) transitions. Within each data table the spectral lines are grouped into multiplets, which are in turn arranged according to parent configurations, transition arrays, and ascending quantum numbers. For each line the transition probability for spontaneous emission and the line strength are given, along with the spectroscopic designation, the wavelength, the statistical weights, and the energy levels of the upper and lower states. For allowed lines the absorption oscillator strength is listed, while for forbidden transitions the type of transition is identified (M1, E2, etc.). In addition, the estimated accuracy and the source are indicated. In short introductions, which precede the tables for each ion, the main justifications for the choice of the adopted data and for the accuracy rating are discussed. A general introduction contains a discussion of the authors method of evaluation and the principal criteria for their judgements. (Copyright (c) 1988 by the U.S. Secretary of Commerce on behalf of the United States. The copyright will be assigned to the American Institute of Physics and the American Chemical Society.)

800,483

PB89-136345 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Electronic Energy Levels of Small Polyatomic Transient Molecules.

Quarterly rept.,
M. E. Jacox. c1988, 243p
Included in Jnl. of Physical and Chemical Reference Data, v17 n2 p269-511 1988. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Polyatomic molecules, *Electron energy, Ions, Vibration, Tables(Data), Measurement, Hydrides, Combustion, Pollution, Molecular beams, Lasers, Ultraviolet spectroscopy, Monohydrides.

The experimentally determined electronic energy levels of approximately 500 neutral and ionic transient molecules possessing from 3 to 6 atoms are tabulated, together with the associated vibrational structure, the radiative lifetime, the principal rotational constants, and references to the pertinent literature. Vibrational and rotational data for the ground state are also given. Observations in the gas phase, in molecular beams, and in rare-gas and nitrogen matrices are included. The types of measurement surveyed include conventional and laser-based absorption and emission techniques, laser absorption with mass analysis, and ultraviolet photoelectron spectroscopy.

800,484

PB89-136352 Not available NTIS
Cookridge Radiation Research Centre, Leeds (England).

Critical Review of Rate Constants for Reactions of Hydrated Electrons, Hydrogen Atoms and Hydroxyl Radicals (.OH/.O(1-)) in Aqueous Solution.

Quarterly rept.,
G. V. Buxton, C. L. Greenstock, W. P. Helman, and A. B. Ross. c1988, 374p
Prepared in cooperation with Atomic Energy of Canada Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment, and Notre Dame Univ., IN. Radiation Chemistry Data Center. Sponsored by National Bureau of Standards, Gaithersburg, MD. Included in Jnl. of Physical and Chemical Reference Data, v17 n2 p513-886 1988. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Hydrogen, *Hydration, *Reaction kinetics, Electrons, Oxides, Photolysis, Steady state, Ions, Statistical analysis, Hydrated electron, Hydroxyl radical.

Kinetic data for the radicals H. and .OH in aqueous solution, and the corresponding radical anions, O- and e sub aq-, have been critically reviewed. Reactions of the radicals in aqueous solution have been studied by pulse radiolysis, flash photolysis and other methods. Rate constants for over 3,500 reactions are tabulated, including reactions with molecules, ions and other radicals derived from inorganic and organic solutes.

800,485

PB89-136360 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Chemical Kinetic Data Base for Combustion Chemistry. Part 3. Propane.

Quarterly rept.,
W. Tsang. c1988, 65p
Included in Jnl. of Physical and Chemical Reference Data, v17 n2 p887-951 1988. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Combustion, *Reaction kinetics, *Propane, Chemical reactions, Thermodynamics, Tables(Data), Pyrolysis, Methane.

The publication contains evaluated and estimated data on the kinetics of reactions involving propane, isopropyl radical, n-propyl radical, and various small inorganic and organic species which are of importance for proper understanding of propane pyrolysis and combustion. It is meant to be used in conjunction with the kinetic data given in earlier publications which are of direct pertinence to the understanding of methane pyrolysis and combustion, but which also contain a large volume of data that are applicable to the propane system.

800,486

PB89-136519 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Thermodynamic Values in the Vicinity of the Specific Volume Anomaly for Water.

Final rept.,
L. Haar, and J. S. Gallagher. 1986, 11p
Pub. in Proceedings of the International Conference on the Properties of Steam (10th), Moscow, USSR, September 3-7, 1984, v1 p304-314 1986.

Keywords: *Thermodynamic properties, *Water, Density(Mass/volume), Abnormalities, Pumps, Turbine pumps, Entropy, Steam, Reprints, Hydraulic pressure pumps.

To test the efficiency of hydraulic pumps and pump-turbines very accurate thermodynamic property values are required. These pumps generally operate over a range of states within 0 less than or equal to t less than or equal to 30 C and P approximately 150 bar. The International Electrotechnical Commission (IEC) had published several tables containing thermodynamic property values for the range, and these currently are the industry standard. In the paper the authors compare very accurate measurements for water over a range of states covered by the IEC standard (and considerably beyond) with values given by the wide-ranging analytic thermodynamic formulation for water and steam reported by Haar, Gallagher and Kell (HGK). These comparisons include the recently reported measurements for the isentropic temperature-pressure coefficients, which relate directly to property values needed for the pump efficiency tests. The authors show that HGK is in accord with these to within reasonable estimates of their accuracy and with PVT measurements for pressurized water. The HGK formula-

tion offers important advantages, and they recommend that the IEC adopt HGK as their technical standard.

800,487

PB89-136568 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Nature of the Glass Transition.

Final rept.,
E. A. Di Marzio. 1984, 10p
Pub. in Relaxations in Complex Systems, p43-52 1984.

Keywords: *Glass transition temperature, *Polymers, Entropy, Lattice parameters, Dissipation, Order disorder transformation, Reprints, Classification.

Reasons are given for the need to study the equilibrium properties of glasses. It is shown that some materials have the amorphous phase as their lowest temperature equilibrium phase. The ubiquitous nature of the glass transition is explained by postulating that glassification occurs when the configurational entropy decreases to a critically small value. The postulate is shown to lead to correct predictions for glass transitions in polymeric systems where the lattice model can be used to calculate the partition function. The fluctuation-dissipation theorem is used to explain the observed parallelism in the behavior of thermodynamic and dissipative variables near the glass transition. Order parameters and collective variables are discussed and defined and application to glasses is made. A constraint on the simultaneous application of the William-Watts formula to both dielectric and mechanical relaxation is described.

800,488

PB89-137590 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Euclidian Distance Mapping for Shape Characterization of Alloy Grain Boundaries.

Final rept.,
D. S. Bright, and D. E. Newbury. 1986, 4p
Pub. in Microbeam Analysis-1986, p521-524.

Keywords: *Grain structure, *Alloys, Grain boundaries, Microstructure, Images, Thickness, Dimensional measurement, Reprints, *Grain structures(Metallurgy), Euclidian distance map.

When monitoring the changes in microstructure of an alloy, it may be desirable to characterize the shape of the grains of the discontinuous phase. Authors have developed a shape measure to detect long thin protuberances which are attached to larger, more rounded parts of the grains. This is a thickness measurement averaged over selected points on the skeleton of the grain. Rounded grains typically have a few large values, while the long, thin protuberances have many small values. Differences in the measure between samples are masked as much by averaging over the large size distribution of grains in the image, as are measures related to grain perimeter and grain area.

800,489

PB89-137632 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Retrograde Condensation of Carbon Dioxide: N-Decane Mixtures on Horizontal Cylinders.

Final rept.,
M. C. Jones, P. J. Giarratano, and L. A. Powers. 1987, 7p
Pub. in Proceedings of National Heat Transfer Conference (24th), Pittsburgh, PA., August 9-12, 1987, p115-121.

Keywords: *Heat transfer coefficient, *Mixtures, Measurement, Carbon dioxide, Decanes, Retrograde condensation, Stability, Reprints.

Measurements of heat transfer coefficients are reported for a horizontal cylinder in a mixture of 97 mole % CO₂, 3.0 mole % n-decane at pressures of 10.4 and 12.2 MPa. The measurements were made in both crossflow and natural convection. These measurements were in the retrograde region of the dew point curve and show enhancement due to the formation of a condensate film on the surface. When wall temperatures were about 50 K above bulk fluid temperatures, they became unstable and multiple steady states were observed by first increasing and then decreasing the heat flux. Associated wall temperatures approximate those of the dew point extremum of the x-T phase dia-

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gram. It is conjectured that this behavior is accompanied by the drying out of the surface in analogy with the transition from nucleate to film boiling.

800,490

PB89-137673

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Chemical Process Metrology Div.

Evaluation of Relative Humidity Values for Saturated Aqueous Salt Solutions Using Osmotic Coefficients between 50 and 100 C.

Final rept.,

P. H. Huang, and J. R. Whetstone. 1985, 20p

Pub. in Proceedings of the International Symposium on Moisture and Humidity, Washington, DC., April 15-18, 1985, p577-596.

Keywords: *Humidity, *Gibbs free energy, Computation, Solution, Water, Osmosis, Reprints, Aqueous solutions.

A new method is used to calculate the values of relative humidity and Gibbs energies of water at one atmosphere for eighteen saturated and stable uni-univalent, uni-bivalent, and bi-univalent water saturated salt solutions. The work extends Greenspan's evaluation of saturated salt solution data (2) to temperatures to 100 C over the range of relative humidities through the use of a larger group of saturated salt solutions. The method uses accurately represented correlating equations for the osmotic coefficient and experimentally determined osmotic coefficient values for the systems at 25 C. The form of the Weiss equation is used to fit values of the saturated salt solution molalities up to a temperature of 100 C. Corrections for the non-ideality of water vapor are made. The results for saturated aqueous sodium chloride solutions are compared with those obtained from a rigorous thermodynamic method. The thermodynamic approach is limited by the extent of the existing data set of apparent molal heat capacity and relative apparent molal enthalpy as a function of molality.

Polymer Chemistry

800,491

PB88-175690

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Polymers Div.

Growth Regimes and the Time Development of Lateral Habits in Polyethylene Crystals.

Final rept.,

E. Passaglia, and E. A. DiMarzio. 1986, 7p

Pub. in Polymer 27, n4 p510-516 1986.

Keywords: *Polyethylene, *Crystal growth, Reprints.

On the assumption that in regime I the growth rate of the lateral face of a lamellar crystal is proportional to the length of the faces, and that in regime II the growth rate is independent of the length of the face, the time development of the size and aspect ratio of a polyethylene lamellar crystals is calculated. The aspect ratio is defined as the ratio of the length of the crystal in the 'b' crystallographic direction to that in the 'a' direction. It is assumed that steady state growth obtain, i.e., the solution concentration is constant.

800,492

PB88-175708

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Polymers Div.

Differences in the Molecular Weight and the Temperature Dependences of Self-Diffusion and Zero Shear Viscosity in Linear Polyethylene and Hydrogenated Polybutadiene.

Final rept.,

G. B. McKenna, K. L. Ngai, and D. J. Plazek. 1985, 3p

Pub. in Polymer 26, n11 p1651-1653 Oct 85.

Keywords: *Polyethylene, *Polybutadiene, *Molecular weight, Activation energy, Models, Reprints, *Temperature dependence.

Within the context of a generalized coupling model the authors can support the hypothesis that, while the mode of relaxation for self diffusion (D) and shear flow (η) are the same, the entanglement interactions are different. They assume that there are two distinct coupling parameters n (sub D) and n (sub η) for self dif-

fusion and shear flow respectively. The model predicts the molecular weight and temperature dependences to be scaled by the relevant coupling parameters.

800,493

PB88-175716

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Polymers Div.

Constraint Release and Self Diffusion in Polymer Melts.

Final rept.,

G. B. McKenna. 1985, 3p

Pub. in Polymer Communications 26, n11 p324-326 Nov 85.

Keywords: *Polymers, *Melts, Molecular weight, Constraints, Releasing, Reprints.

The constraint release model for diffusion of chains of mass M into a matrix of chains having mass P is examined in the self-diffusion limit, $M=P$. The model is found not to be consistent with reported results for molecular weights up to ten times the entanglement molecular weight.

800,494

PB88-178546

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Polymers Div.

Estimation of the Amount of Adjacent Reentry in Polymer Crystallization: 1. The Basic Equations.

Final rept.,

E. A. Di Marzio, and E. Passaglia. 1987, 7p

See also PB88-152079.

Pub. in Jnl. of Chemical Physics 87, n8 p4901-4907, 15 Oct 87.

Keywords: *Polymers, *Crystallization, Reaction kinetics, Alkanes, Reprints.

The authors develop a treatment of polymer chain folded crystallization in which stems are incorporated into the crystal by both adjacent and nonadjacent reentry. By defining certain stages of partial incorporation of a molecule as separate species, they have been able to adapt a kinetic transfer matrix technique derived previously to solve the problem of the growth of multicomponent chains to the solution of the present problem. A prescription is given for obtaining the relative amounts of adjacent and nonadjacent reentry as a function of the forward and backward rate constants for stem incorporation. The difficult problem of determining the rate constants as well as the actual numerical calculations are presented in a subsequent paper.

800,495

PB88-179882

PC A03/MF A01
National Bureau of Standards (NIST), Gaithersburg, MD. Polymers Div.

Polymer Composite Processing. An Industry Workshop Held at Gaithersburg, Maryland on October 7, 1987.

P. Beardmore, and D. Hunston. Feb 88, 47p NBSIR-87/3686

Prepared in cooperation with Ford Motor Co., Dearborn, MI.

Keywords: *Composites, *Polymers, Compression molding, Filament winding, Process control, Processing, Pultrusion, Thermoforming, Transfer molding, *Autoclave molding.

The report describes the proceedings of an Industry Workshop held at the National Bureau of Standards on October 7, 1987. The Workshop sought to facilitate the expanded use of polymer composites by analyzing the urgent need for improved processing. The Workshop goals were to identify the most promising processing methods for the future and the critical barriers to their implementation. The attendees represent 23 different companies including composite users, suppliers, and fabricators. Five processing methods were selected as most important for the future: pressure molding, transfer molding, filament winding, thermoforming, pultrusion. In addition, two technologies that complement processing were also chosen as very important: resin coating of fibers; alternate sources of energy input. The Workshop concluded that the most critical barriers to implementation of improved processing are inadequate understanding of: resin flow and fiber orientation; temperature gradients and heat flow; fiber-matrix interface; data validation, test standardization; morphology control; surface quality, dimensional tolerances. Increased knowledge in these areas is needed to implement process control and automation which

the Workshop felt were keys to more rapid, reliable, and cost effective processing.

800,496

PB88-189907

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Polymers Div.

Epoxy Network Structure (III). Neutron-Scattering Study of Epoxies.

Final rept.,

W. L. Wu, and B. Bauer. 1986, 6p

Pub. in Macromolecules 19, n6 p1613-1618 1986.

Keywords: Reprints, Block copolymers, Deuterium labeling, *Epoxy, Network, *Neutron scattering, Superlattice.

Neutron scattering studies of partially deuterated epoxies were performed on specimens containing mixtures of amines of the same chemical repeat unit but with different molecular weights. The epoxy monomer used was a partially deuterated diglycidyl ether of Bisphenol A (DGEBA), and the diamines were linear diamines of poly(propylene oxide) chains. A pronounced scattering maximum was observed in specimens cured with a mixture of diamines at a q region smaller than what observed in specimens made from any of the constituent amines alone. A molecular network model with regularly alternating blocks was the obvious choice to accommodate the scattering results. Each unit consists of two amines and two DGEBA monomers. The term 'alternating' refers to the connection between the long chain and the short chain blocks. An analytic solution of linear Gaussian chains and rigid rods was obtained to illustrate the effect of polymer structure on the position of the scattering maximum.

800,497

PB88-189915

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Polymers Div.

Temperature Effects in Crystalline Polyethylene Dielectric Relaxation.

Final rept.,

K. J. Wahlstrand. 1988, 5p

Pub. in Polymer 29, p263-267 Feb 88.

Keywords: Temperature, Reprints, *Soliton model, Relaxation, *Crystalline polyethylene, Conformational defects, Defect barrier model, Cole-Cole plots, Noncontinuum regime.

Recently the authors proposed a soliton model for the crystalline alpha-relaxation in polyethylene. The continuum limit theory accounted reasonably well for the observed dielectric data at low temperatures, but failed to explain the change in the shape of the Cole-Cole plots (increase in the Cole-Cole width parameter beta) with temperature. The authors extend the theory by considering the effects of both conformational defects and soliton interactions. In the defect barrier model the conformational defects are modelled as infinite reflecting or absorbing barriers to soliton motion. The results in a beta = 0.48 Williams-Watts dielectric decay function not significantly different from the defect-free result, which predicts no change in the shape of the Cole-Cole plot with temperature. Recent simulation results in the non-continuum (interacting soliton) regime demonstrate temperature-dependent power-law behavior, which gives qualitative but not quantitative agreement with the experiments at higher temperatures. It is suggested that the conformational defects may act as effective barriers to soliton motion, improving the quantitative comparison with the experiments.

800,498

PB88-194402

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Polymers Div.

Fluorescence Monitoring of Viscosity and Chemical Changes during Polymerization.

Final rept.,

F. W. Wang, R. E. Lowry, W. J. Pummer, B. M. Fanconi, and E. S. Wu. 1987, 9p

Sponsored by Army Research Office, Research Triangle Park, NC.

Pub. in ACS (American Chemical Society) Symposium Series 358, p454-462 1987.

Keywords: *Epoxy resins, *Polyimide resins, *Polymerization, *Curing, Viscosity, Fluorescence spectroscopy.

Three approaches using fluorescent dyes dissolved in epoxy resins were used to determine the viscosity

changes during the curing process. First, the intensity of excimer fluorescence from a dye which forms an intramolecular excimer was measured to determine the viscosity changes. In another approach, the authors used a dye whose fluorescence intensity increases with the increase in the local viscosity, and a second dye whose fluorescence intensity is insensitive to the local viscosity. The ratio of the fluorescence intensities of the two dyes was measured to monitor the cure of epoxy resins. In a third approach, the authors measured the diffusion technique to monitor the curing process. Finally, they used a fluorescence technique to monitor the formation of a polyimide polymer from poly(amide acid).

800,499
PB88-198924 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Epoxy Network Structure. 4. A Neutron Scattering Study of Epoxies Swollen in a Deuteriated Solvent. Final rept., W. L. Wu, D. L. Hunston, H. Yang, and R. S. Stein. 1988, 9p
See also PB88-189907.
Pub. in *Macromolecules* 21, n3 p756-764 1988.

Keywords: *Thermosetting resins, *Polypropylene, *Epoxy resins, *Polymers, *Diamines, Molecular structure, Neutron scattering, Solvents, Reprints, Macromolecules.

The molecular network structure of epoxy specimens made from diglycidyl ether of bisphenol A and linear diamines of a poly(propylene oxide) chain was investigated using neutron scattering. Deuteriated acetone was used to swell these epoxies and to provide the scattering contrast. The molecular weight of the diamines was chosen to be the experimental variable in the present work.

800,500
PB88-217609 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Characterization of Organometallic Polymers by (13)C- and (119)Sn-NMR: Configurational/Compositional Triads in Poly(Tri-n-Butyltin Methacrylate/Methyl Methacrylate). Final rept., W. F. Manders, J. M. Bellama, R. B. Johannesen, E. J. Parks, and F. E. Brinkman. 1987, 9p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in *Jnl. of Polymer Science. Part A. Polymer Chemistry* 25, p3469-3477 1987.

Keywords: *Stereochemistry, *Organometallic compounds, *Isotopic labeling, Nuclear magnetic resonance, Free radicals, Chemical analysis, Chemical composition, Copolymers, Reprints, Methacrylic acid/methyl ester, Methacrylate/tributyltin-(Methyl ester).

The 1:1 and 2:1 formulations of the free radical initiated copolymers of methyl methacrylate (MMA) and tri-n-butyltin methacrylate (TBTM), and the homopolymer, poly(TBTM), are characterized by (13)C- and (119)Sn-NMR. (13)C-NMR structural analyses were performed on the tributyltin-free hydrolyzate, a copolymer of MMA and methacrylic acid (MAA). Configurational sequencing at the triad level is performed using the α -methyl region of the (13)C-NMR spectrum. Random compositional sequencing is established for the copolymers through a comparison of the carbonyl regions of the (13)C-NMR spectra of the hydrolyzates with the carbonyl regions in published spectra of structurally characterized copolymers of MMA and MAA. The (119)Sn chemical shift and the tin-carbon J coupling for the polymers are dependent on the solvent employed. This dependence is attributed to electron donor or acceptor interactions between the solvent and the strong Sn-O dipole. The tin-containing copolymers exhibit multiple (119)Sn resonances, which appear related to compositional sequencing.

800,501
PB88-218151 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Summary Abstract: Preparation of Polymer Molecules for Examination by Scanning Tunneling Microscopy. Final rept., D. H. Reneker, and B. F. Howell. 1988, 2p
Pub. in *Jnl. of Vacuum Science and Technology A* 6, n2 p553-554 Mar/Apr 88.

Keywords: *Polymers, Polyethylene, Reprints, *Scanning tunneling microscopy, Poly(ethylene/tetrafluoro).

Progress in the exploration of some methods to produce single, isolated segments of a polymer molecule on a conduction substrate for examination by scanning tunneling microscopy. This is an extended abstract of a paper presented at the Second International Conference on Scanning Tunneling Microscopy/Spectroscopy.

800,502
PB88-228168 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

New Polydiacetylenes Incorporating Mesogenic Side-Chains. Final rept., M. A. Schen. 1988, 8p
Pub. in *Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Advances in Nonlinear Polymers and Inorganic Crystals, Liquid Crystals, and Laser Media*, San Diego, CA., August 20-21, 1987, v824 p93-100 1988.

Keywords: *Polymers, Liquid crystals, *Polydiacetylenes, Diacetylene monomer, Non-linear optics.

The categorization of existing polydiacetylene structures according to the nature of the polymer side-chain interactions is presented. Opportunities for generating new diacetylene molecular architectures based on creating mesogenic side-chains then becomes evident. Carrying through on this concept, the synthesis of four new symmetric diacetylene monomers based on the N-benzylideneaniline and cyanobiphenyl mesogens is reported. 1,6-Bis(N-(4-oxybenzylidene) 4-octylaniline) 2,4-hexadiyne (1-OBOA) contains a methylene oxide spacer between the mesogen and the diacetylene core and shows smectic liquid crystalline textures over a broad temperature range. Monomers containing a tetramethylene-oxide spacer do not show liquid crystallinity as monomers but are intended to result in liquid crystalline polymer.

800,503
PB88-238886 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Multiple Melting Peaks of Poly(aryl ether ether ketone). Final rept., S. S. Chang. 1988, 4p
Pub. in *Polymer Communications* 29, p138-141 May 88.

Keywords: *Polymers, *Thermoplastic resins, *Melting points, Compositions, Thermal stability, Toughness, Melting, Isothermal annealing, Samples, Reprints, *Poly(aryl ether ether ketone), Crystallinity.

Thermoplastics are increasingly popular as the base resin for polymeric composites. PEEK, poly(aryl ether ether ketone), with its toughness and thermal stability, has received wide interest recently as the base resin for high performance thermoplastic composites. The overall crystallinity of PEEK is generally in the order of 30 percent, although crystallinities from 0 to 40 percent may be obtained depending on particular thermal histories. Detailed studies by d.s.c. revealed a highly complicated crystallization and melting behavior. Between the Tau (sub g) of about 150 deg C and the Tau (sub m) of about 350 deg C, any isothermal annealing or soaking will produce a secondary melting peak at about 10 deg C above the annealing temperature. Ten or more such peaks may easily be resolved from samples that have been cooled in steps. It is expected that these samples will show equally complicated mechanical behavior.

800,504
PB88-238894 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Comparison of Diffusion Coefficients in Ternary Polymer Solutions Measured by Dynamic Light Scattering and Forced Rayleigh Scattering. Final rept., T. Chang, C. C. Han, L. M. Wheeler, and T. P. Lodge. 1988, 3p
Pub. in *Macromolecules* 21, n6 p1870-1872 1988.

Keywords: *Diffusion coefficient, *Polymers, Diffusion, Probes, Refractivity, Solutions, Light scattering, Rayleigh scattering, Ternary systems, Reprints.

Two completely different techniques, i.e., Dynamic Light Scattering (DLS) and Forced Rayleigh Scattering (FRS), were used to measure the self diffusion of a probe polymer chain in ternary solutions. Three important questions have been addressed in this work. (1) In a (polymer A/polymer B/solvent) ternary system, is refractive index matching of solvent and polymer B sufficient to give self diffusion of polymer A by DLS. (2) Since DLS and FRS have very different q-range, this note also addresses the questions whether both experiments measure the same diffusion mechanism in a semidilute polymer solution. (3) Is the concentration correction for the probe chain necessary in the DLS. All three questions have been discussed in this note.

800,505
PB88-238902 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Dynamics of Phase Separation in Binary Polymer Mixtures. Final rept., C. C. Han. 1988, 25p
Pub. in *Studies in Polymer Science* 2, p223-247 1988.

Keywords: *Polymers, Denterium compounds, Polystyrene, Vinyl ether resins, Neutron scattering, Light scattering, Thermodynamic equilibrium, Concentration(Composition), Variations, Extrapolation, Diffusion coefficient, Critical point, Binary mixtures, *Spinodal decomposition, Small angle scattering.

The statics and kinetics of spinodal decomposition of a binary polymer system of deuterated polystyrene/poly(vinylmethylether), (PSD/PVME), has been studied by the small angle neutron scattering and time resolved light scattering experiments. It can be demonstrated that the equilibrium concentration fluctuation can be well described by the Random Phase Approximation of de Gennes. Thermal fluctuations which have been introduced by Cook has to be included and extrapolation scheme has to be used in order to obtain the limiting rate of concentration growth, $R(q)$. Cahn-Hilliard-Cook calculation can be verified quantitatively. The continuity of the apparent diffusion coefficient has been observed across critical point. Static structure factor, $S(q)$, from SANS was combined together with the kinetics results to check the consistency of the linearized theory through the relationship of $R(q)=(q^2 \text{ squared})M/S(q)$, with M being the mobility. Non-linear behavior comes in early with additional higher order of q contribution to the apparent growth rate, $R(q)$.

800,506
PB89-126734 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Dilute Solution Characterization of Cyclic Polystyrene Molecules and Their Zero-Shear Viscosity in the Melt. Final rept., G. B. McKenna, G. Hadzioannou, P. Lutz, G. Hild, C. Strazielle, C. Straupe, R. Rempp, and A. J. Kovacs. 1987, 15p
Pub. in *Macromolecules* 20, n3, p498-512 1987.

Keywords: *Polystyrene, *Melts, *Viscosity, *Molecular weight, Cyclization, Dilution, Solvolysis, Cyclohexane, Linearity, Reprints, Reptation, Entanglement.

Narrow fractions of polystyrene molecules in the form of uncatenated rings (cycles) were synthesized by reacting bifunctional living linear precursors with an appropriate coupling agent at very low concentrations. The cyclic molecules were separated from the simultaneously formed linear polycondensates by fractionate precipitation. The molecular weights of the cycles ranged from 11,100 to 185,000, thus encompassing the critical molecular weight for entanglements in linear polystyrene. The ring-like nature of these fractions has been investigated by a variety of techniques, including the limiting viscosity number in a good and in a theta solvent as well as neutron scattering in deuterated cyclohexane. These display a gratifying agreement with the theoretical predictions reported earlier for uncatenated cyclic polymers. Above the critical molecular weight for entanglement coupling, no major differences were found between the temperature dependence or the molecular weight dependence of the cyclic polymers and those of their linear counterparts. For the same molecular weight, however, the cycles exhibit somewhat lower melt viscosity values than do the linear molecules. The results are briefly discussed in terms of recent molecular theories based on snake-

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like motion (reptation) of chains along a curvilinear tube formed by the constraints of the surrounding entangled matrix.

800,507

PB89-136550

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Trends in Polymer Development and Analytical Techniques.

Final rept.,

B. M. Fanconi. 1984, 22p

Pub. in Proceedings of the International Symposium on the Analysis and Identification of Polymers, Quantico, VA., July 31-August 2, 1984, p87-108.

Keywords: *Polymers, Trends, Measurement, Assaying, Nuclear magnetic resonance, Reprints, Polymer matrix composites, Polymer blends.

Examples of the newer materials are polymer matrix composites and polymer blends. These materials are often complex mixtures of polymeric and non-polymeric materials. For example, a polymer blend that might be used as a substitute may be specifically identified as it is composed of several major constituents that are manufacturer specific. A similar situation exists for composites with the caveat that characterization of these materials may not be amenable to some common characterization techniques. Molecular weight and molecular weight distribution are two fundamental properties of polymers that are determined by polymerization conditions and to a lesser extent by the processing and use environment. Molecular weight measurements require dissolution, a process that may destroy the unique microstructure of a polymer blend. In polymer composites polymerization (curing) and processing are combined to produce a three-dimensional (cross-linked) solid state structure that is intractable. Characterization of these materials requires newly developed techniques. New methods, for example nuclear magnetic resonance (NMR), have been developed.

General

800,508

PB88-168323

PC A08/MF A01
National Bureau of Standards, Gaithersburg, MD.

NBS (National Bureau of Standards) Standard Reference Materials Catalog 1988-89.

Special pub. (Final),

R. W. Seward. Jan 88, 158p NBS/SP-260

Supersedes PB86-227592. Also available from Supt. of Docs. as SN003-003-02841-0.

Keywords: *Catalogs (Publications), Standards, *Standard reference materials.

The catalog describes the Standard Reference Materials (SRM's) currently available from the National Bureau of Standards (NBS), lists those in preparation, and provides ordering information. The descriptions provide nominal values for these SRM's. Certified values are provided in the certificates that accompany each SRM.

800,509

PB88-173950

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Length and Mass Div.

1 kg Mass Comparator Using Flexure-Strip Suspensions: Preliminary Results.

Final rept.,

T. J. Quinn, C. C. Speake, and R. S. Davis. 1987, 14p

Pub. in Metrologia 23, n2 p87-100 1987.

Keywords: *Weight indicators, Comparators, Mass, Design, Reprints, *Balances.

The paper describes the design and construction of a novel form of equal-arm balance having flexure-strip suspensions. The balance has been designed to study the performance of flexure strips for use as pivots in a 1 kg mass comparator working at the highest accuracy. The beam of the balance is servo controlled, using optical detection of angular position and electromagnet control. Small mass differences are measured in terms of the differences in the servo currents required to reproduce the same position of the beam. Preliminary

results indicate that an accuracy in mass comparison of about 5 parts in 10 billion can be achieved.

800,510

PB88-177605

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Acuchem: A Computer Program for Modeling Complex Chemical Reaction Systems.

Final rept.,

W. Braun, J. T. Herron, and D. K. Kahaner. 1988, 12p

Pub. in International Jnl. of Chemical Kinetics 20, p51-62 1988.

Keywords: Computers, Data, Modeling, Reprints, *Chemical kinetics, Chemical reactions, Personal computers.

Acuchem is a program for solving the system of differential equations describing the temporal behavior of spatially homogeneous, isothermal, multicomponent chemical reaction systems. It is designed to provide modelers, data evaluators, and laboratory scientists with an easy to use program for modeling complex chemical reactions, and for presenting the results in tabular or graphical form. The program is described and some examples of its application given. Acuchem is designed to operate on the IBM Personal Computer family and other compatible microcomputers, and is available in a compiled version on a floppy disk.

800,511

PB88-194014

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.

Some Recent Developments at NBS (National Bureau of Standards) in Mass Measurement.

Final rept.,

R. M. Schoonover, and J. E. Taylor. 1986, 5p

Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Instrumentation and Measurement Technology Conference, Boulder, CO., March 25-27, 1986, p119-123.

Keywords: *Mass, Weight indicators, Weight measurement, Buoyancy, Balances, US NBS.

During the early 1970's the results of a routine circulation of some mass artifacts between several laboratories revealed unexpected systematic errors. The authors interest in understanding these anomalies led us to undertake several projects that are soon to be incorporated into a new 'round-robin' effort. They believe this new work will demonstrate that the mass unit can be disseminated through artifacts of less than ideal characteristics and the results remain free of serious systematic errors. Such a demonstration will not only increase our confidence in the calibration of mass standards but should also point to areas where fine-tuning can yield further improvements on a laboratory-by-laboratory basis. They will discuss the effects on mass measurement of artifact characteristics, i.e., geometry, thermal conductivity, density, and others. The role played by the interaction of these artifact properties with ambient conditions are important to the outcome of a mass measurement process. To minimize these interactions they have applied electronic control circuitry to the weighing process. Our next 'round-robin' weight package will contain the developments which are discussed in the paper.

800,512

PB88-204425

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.

New Subcommittee on Reference Materials.

Final rept.,

S. D. Rasberry. 1987, 3p

Pub. in Chemistry International 9, n4 p142-144 1987.

Keywords: Standards, Calibrating, Reprints, *Reference materials.

A Subcommittee on Reference Materials in Chemistry was established by the Physical Chemistry Division Committee in 1985 and began work during 1986. The Chairman and other members of the Subcommittee provide, by means of this brief article, a summary of the aims and responsibilities of the Subcommittee. Further, some background information is provided on international activities related to reference materials.

800,513

PB89-123871

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.

NBS (National Bureau of Standards) Primary Flow Calibration Facilities for Air and Slurries.

Final rept.,

K. R. Benson, N. E. Mease, G. Kulin, and G. E.

Mattingly. 1987, 7p

Pub. in InTech 34, n1 p43-49 Jan 87.

Keywords: *Calibrating, *Flowmeters, *Slurries, *Fluid flow, *Air flow, Performance evaluation, Reprints, National Bureau of Standards.

Increased concerns for improved fluid measurements exist today in our nation's marketplaces, in our continuous process industries, and in the technologies which impact public safety and our national defense. To respond to these concerns, improvements are being sought in fluid measurements in existing installations and in fluid meters which are being retrofitted into flow systems where none previously existed. For all of these reasons, the NBS calibration facilities for fluid flow should be known, accessible, and adequate to expressed needs. The NBS calibration techniques, facilities, ranges and levels of performance are briefly described for air flowrate, air speed, and slurry flow meter calibration services.

800,514

PB89-124002

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Performance Characteristics of NBS (National Bureau of Standards) Glass and Metal-on-Quartz Transmittance Standards.

Final rept.,

R. W. Burke, M. V. Smith, L. J. Powell, and R.

Mavrodineanu. 1986, 4p

Pub. in American Laboratory 18, n7 p67-70 1986.

Keywords: *Transmittance, *Spectrophotometers, Performance evaluation, Calibrating, Standards, Reprints, *Certified reference materials, *Glass filters, *Metal on quartz filters, Standard reference materials.

In response to numerous requests from users of spectrophotometers, the National Bureau of Standards initiated a program to develop means for measuring optical transmittances with well-defined accuracy and to provide certified materials that could be used to verify the transmittance accuracy and monitor the stability and reproducibility of conventional spectrophotometers. The first transmittance standard that was issued, SRM 930, Glass Filters for Spectrophotometry, consists of three neutral glass filters (10, 20 and 30% T) which are individually calibrated and certified for transmittance over a range of wavelengths from 440-635 nm. SRM 2031, Metal-on-Quartz Filters for Spectrophotometry, was developed in response to many requests, particularly from clinical chemists, for NBS to provide solid transmittance filters in the ultraviolet. The paper discusses the long-term stability and other performance characteristics of SRM 930 and SRM 2031 as they pertain to using these two SRMs for verifying the accuracy of spectrophotometers.

800,515

PB89-124846

Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.

Laboratory Applications of the Vortex Tube.

Final rept.,

T. J. Bruno. 1987, 2p

Pub. in Jnl of Chemical Education 64, n11 p987-988 1987.

Keywords: *Laboratory equipment, *Hilsch tubes, Design criteria, Performance evaluation, Reprints.

It occurs very often in science and technology that devices, theories and approaches from one field will suddenly find profitable application in a completely unrelated field. As often as not, the new application or approach may be decades old in its own discipline. This is the case with a simple device called the vortex tube, which may be regarded as Maxwell's demon in a pipe. In the paper, a brief explanation of the function of the vortex tube will be given, and some applications for the chemistry laboratory discussed.

800,516

PB89-126387

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.

Present Status of the Leak Standards Program at the National Bureau of Standards. Summary Abstract.

Final rept.,
C. D. Ehrlich. 1987, 2p
Pub. in Jnl. of Vacuum Science and Technology A 5, n1 p125-126 Jan/Feb 87.

Keywords: *Helium, *Leakage, *Standards, Calibration, Reprints, National Bureau of Standards.

The National Bureau of Standards (NBS) has offered a 'Special Test Service' for helium permeation (or diffusion) leaks, over the range of leak rates 10 to the -8th power to 10 to the -11th power mol/s (2×10 to the -4th power to 2×10 to the -7th power atm cc/s at 0 degrees C), since the summer of 1986. It is anticipated that the service will become a full 'Calibration Service' in 1988. Besides offering the service, another of the goals of this program has been to characterize the stability and reproducibility of transfer leaks over the long and short term. This has been done for the helium diffusion leak artifact, and investigations into other types of artifacts will begin shortly. As with the permeation leaks, these investigations will include the thermal equilibrium and nonequilibrium properties of these artifacts. Other gases besides helium will also be studied, as will the appropriate ranges of use. Extending the service beyond what is now offered will depend on the results of these investigations.

800,517
PB89-136337 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 17, Number 2, 1988.
Quarterly rept.
c1988, 696p
See also PB89-136345 through PB89-136360 and PB88-156435. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Chemical reactions, *Chemical analysis, *Polyatomic molecules, Electrons, Rotation, Vibration, Surges, Molecular beams, Reaction kinetics, Propane, Combustion, Pyrolysis, Thermodynamics.

Contents: Electronic energy levels of small polyatomic transient molecules; Critical review of rate constants for reactions of hydrated electrons, hydrogen atoms and hydroxyl radicals (OH/O-) in aqueous solution; Chemical kinetic data base for combustion chemistry. Part 3. Propane; Cumulative listing of reprints and supplements.

CIVIL ENGINEERING

Civil Engineering

800,518
PB88-176920 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Geometric Elements for Pipe Routing Using a Computer.
Final rept.,
M. Roche. 1986, 10p
Pub. in Civil Engineering for Practicing and Design Engineers 5, p975-984 1986.

Keywords: *Pipes(Tubes), *Ducts, *Rooting, Network flows, Algorithms, Reprints, Three dimensional.

Algorithms have been developed for the design of arbitrary three-dimensional pipe (duct) routing. The pipe center line is defined by a polygon of line segments and an array of elbow radius values. A two-dimensional cross section is positioned and scaled along the length of the center line.

800,519
PB88-187729 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.

Disturbance Propagation Approach to the Dynamic Characterization of Linear Flexible Structures.

Final rept.,
A. S. Carasso, and E. Simiu. 1987, 4p
Pub. in Proceedings of National Structural Engineering Conference (1st), Melbourne, Australia, August 26-28, 1987, p341-344.

Keywords: *Structural analysis, Dynamic response, Greens function, Timoshenko beams, Deconvolution, System identification.

A method is presented for experimentally identifying the dynamic behavior of linear structural systems. The method is based on propagating specific pulse disturbances through the structure and analyzing the output responses. The technique is illustrated with a numerical experiment on reconstructing the dynamic Green's function of a flexible member of Timoshenko beam type.

Construction Equipment, Materials, & Supplies

800,520
PB88-164504 PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Tensile Test to Measure Adhesion between Old and New Cement Paste,
L. Struble, and N. Waters. Oct 87, 32p NBSIR-87/3685
Sponsored by Corps of Engineers, Washington, DC., Naval Facilities Engineering Command, Alexandria, VA., and Air Force Engineering and Services Center, Tyndall AFB, FL.

Keywords: *Concretes, *Cements, *Tension tests, Adhesion, Maintenance, Bonding strength.

A tensile test has been developed to measure the adhesion of repair material to hardened concrete using specimens of repair material cast between two cylinders of hardened substrate material. Cement paste was used as the model material for both the repair material and the hardened substrate. Aspects of the test procedure that appeared to affect the strength data included the jig used to cut the hardened substrate surface in preparing the composite specimen, the grips used during the tensile test, the crosshead speed, exposure condition during loading, and possibly the age of the repair material.

800,521
PB88-168596 PC A05/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Proceedings of the Conference on Accreditation of Construction Materials Testing Laboratories Held at Gaithersburg, Maryland on May 14-15, 1986.
Special pub. (Final),
J. H. Pielert, and C. B. Spring. Nov 87, 88p NBS/SP-736
Also available from Supt. of Docs. as SN003-003-02837-1. See also PB86-245719. Library of Congress catalog card no. 87-619889. Sponsored by American Society for Testing and Materials, Philadelphia, PA., American Association of State Highway and Transportation Officials, Washington, DC., and American Concrete Inst., Detroit, MI.

Keywords: *Construction materials, *Laboratories, *Evaluation, *Meetings, Standards, Concretes, Cements, Aggregates, Rock tests, Soils, Masonry, Wood.

A two-day Conference hosted by NBS was held in Gaithersburg, Maryland on May 14-15, 1986 to test the hypothesis that 'There is a need for a coordinated methodology for accrediting construction materials testing laboratories'. Construction materials include primary materials such as: cement, concrete, aggregates, rock and soil, asphalts, metals, wood and masonry. The Conference was structured to consider: (1) the status of existing laboratory evaluation and accreditation programs; (2) current trends in the accreditation process; and (3) the need for and nature of a coordinated accreditation system. The Conference included the presentation of invited papers and four workshop sessions.

800,522

PB88-174750 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
New Statistical Method for Prediction of Concrete Strength from In-Place Tests.
Final rept.,
W. C. Stone, and C. P. Reeve. 1986, 10p
Pub. in Cement and Concrete Aggregates 8, n1 p3-12 1986.

Keywords: *Concrete, *Compressive strength, Statistical analysis, Reprints.

A method is presented for determining the relationship (correlation equation) between in-place tests and the compressive strength of concrete. The method accounts for the variability in both X (in-place) and Y (compressive strength) variables. The variance and co-variance of the regression equation coefficients (a measure of the scatter in the correlation data) is calculated for future use in predicting in-place compressive strength.

800,523

PB88-174768 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Statistical Methods for In-Place Strength Predictions by the Pullout Test.
Final rept.,
W. C. Stone, N. J. Carino, and C. P. Reeve. 1986, 12p
Pub. in Jnl. of the American Concrete Institute 83, n5 p745-756 1986.

Keywords: *Concrete, *Pull tests, Statistical analysis, Aggregates, Strength, Mechanical properties, Reprints.

Pullout tests and companion cylinder tests were conducted to examine characteristic variations in ultimate load with respect to concrete strength, and to provide experimental data for the development of a new statistical procedure for predicting in-place compressive strength from the pullout test. A method is presented to determine the appropriate number of in-place tests to be performed for a given concrete placement. A recommended minimum number of 8-12 pullout tests per 76 cubic meters (100 cubic yards) is proposed.

800,524

PB89-126981 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Cement and Concrete Reference Laboratory.
Final rept.,
J. H. Pielert. 1984, 2p
Sponsored by American Society for Testing and Materials, Philadelphia, PA.
Pub. in Concrete International, p55-56 Nov 84.

Keywords: *Cements, *Reinforced concrete, *Tests, *Standards, *Archives, Reinforcing steels, Laboratories, National government, Sampling, Reprints.

The Cement and Concrete Reference Laboratory (CCRL) was established in April 1929 as a Research Associate Program at the National Bureau of Standards. The CCRL has four major functions which promote uniformity and improvement in the testing of cements, concretes and reinforcing steel: (1) inspection of materials testing laboratories; (2) distribution of proficiency test samples; (3) study of special testing problems; and (4) participation in the work of technical committees. The current status of these activities are discussed.

800,525

PB89-127187 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. National Voluntary Lab. Accreditation Program.
Importance of Selecting a Qualified Testing Laboratory.
Final rept.,
R. L. Gladhill. 1986, 2p
Pub. in Concrete Construction 31, n8 p731-732 Aug 86.

Keywords: *Concretes, *Laboratories, *Qualifications, *Standards, Construction, Tests, Selection, Reprints, Accreditation.

CIVIL ENGINEERING

Construction Equipment, Materials, & Supplies

The article describes the role of the concrete testing laboratory in the construction process and the reasons for taking care in the selection of a laboratory. The use of accredited laboratories is stressed.

Highway Engineering

800,526
PB89-127260

PC A06/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Evaluation of Colors for Use on Traffic Control Devices.
B. L. Collins. Nov 88, 110p NISTIR-88/3894

Keywords: *Traffic control devices, *Color, *Highway signs, Chromaticity, Visibility, Reflectivity, Safety, Specifications.

Research on color coding, highway safety color codes, color deficiency, retroreflective materials, and conspicuity, is reviewed to evaluate the effectiveness of chromaticity specifications for highway signs and markings. Data from a study by Collins et al (1986) are reanalyzed to compare color appearance data for both ANSI and highway colors viewed under seven illuminants, including several HID sources. The analysis demonstrated that the ANSI colors, especially safety yellow, were identified more accurately in terms of color name, lightness, saturation, and primary hue than the corresponding highway color. In addition, selected measurements of the chromaticity of retroreflective materials were made as background for assessing the feasibility of developing a nighttime chromaticity specification. Based on the analysis of the appearance of safety colors under different illuminants, it is recommended that consideration be given to switching the FHWA specifications for the chromaticity of colors used on traffic control devices to the ANSI specifications.

Soil & Rock Mechanics

800,527
PB88-164231

PC A03/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

Mechanical and Physical Properties of Coquina Stone from the Castillo de San Marcos National Monument.
L. I. Knab, and J. R. Clifton. Jan 88, 23p NBSIR-88/3714

Sponsored by National Park Service, Dunwoody, GA. Historic Architecture Div.

Keywords: *Monuments, Rock properties, Preserving, Compressive strength, St. Augustine(Florida), Coquina stone.

Some important mechanical and physical properties of coquina stone, which was used to construct the Castillo de San Marcos National Monument, were determined to aid in the condition assessment of the monument. Mechanical properties determined included compressive strengths under several different testing conditions, including testing wet as compared to dry, and the direction of the applied load relative to the bedding plane orientation. Physical properties determined included water absorption and dry density. The results indicated that the coquina stone has an extremely low compressive strength relative to common building stone. The low compressive strength was believed to be caused, at least in part, by the friable and very porous nature of the coquina stone.

800,528
PB88-239785

PC A03/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.

Effect of Blow Count on Energy Transfer in SPT (Standard Penetration Tests).
F. Y. Yokel. Jul 88, 23p NBSIR-88/3765

Keywords: *Soil sampling, *Penetration tests, Energy transfer, Energy dissipation, Drilling, Boring, Field tests, Graphs(Charts), Evaluation, Standard penetration test, Blow count.

A rigid-hammer model is used to investigate the effect of the blow count in Standard Penetration Tests on the

energy transmission characteristics of the tests. It is shown that the percentage of the impact energy used to advance the sampler decreases with an increase in blow count and could increase somewhat with increasing drill rod size, and that for low blow counts several penetration cycles are required to transmit the energy to the sampler. The effect of the blow count on the energy loss associated with short drill rod lengths is also investigated. It is shown that the energy loss associated with the short-rod effect is less than that predicted when total energy rather than useable energy is considered, and that the energy loss decreases with an increase in blow count.

800,529

PB89-107072

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Helical Probe Tests: Initial Test Calibration.

Final rept.,

F. Y. Yokel, and P. W. Mayne. 1988, 8p

Pub. in ASTM (American Society for Testing and Materials) Geotechnical Testing Jnl. 11, n3 p179-186 Sep 88.

Keywords: *Soil mechanics, *Soil tests, Civil engineering, Mechanical properties, Investigations, *Soil properties, Calibrating, Construction, Field tests, Helical probe tests, *In situ tests, *Standard penetration tests, Cone penetration tests, Dilatometer tests, In situ density tests.

Helical test probes of different sizes suitable for shallow (1.8-m) in-situ soil exploration and compaction control were developed and tested in different soils alongside traditional in-situ tests, including Standard Penetration tests (SPT), cone penetration tests (CPT), dilatometer tests (DMT), and in-situ density tests. The helical probe test (HPT) is a quick and economical test, which can be performed by a single person in less than 10 min, making it very attractive for construction field testing on geotechnical projects. The torque necessary to insert the probe is used as a measure of soil characteristics. Preliminary studies indicate that the HPT test correlates well with the SPT test and the correlation is not sensitive to the soil type (particle size); the HPT test correlates well with the CPT test, but the correlation is sensitive to the soil type; and the HPT/SPT and HPT/CPT correlations are consistent with existing data on SPT/CPT correlations. After site calibration, the HPT torque can be used to estimate relative compaction and in-situ density of compacted soils.

COMBUSTION, ENGINES, & PROPELLANTS

Combustion & Ignition

800,530

PB88-164041

PC A10/MF A01

Brown Univ., Providence, RI.

Thermophoretic Sampling and Soot Aerosol Dynamics of an Ethene Diffusion Flame.

Doctoral thesis,

C. M. Megaridis. Dec 87, 211p NBS/GCR-87/532

Grants NB83-NADA-4025, NAMB-D0643

Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Diffusion flames, *Ethylene, Soot, Particle size distribution, Aerosols, Particle shape, Electron microscopy.

A detailed investigation of the sooting structure of an overventilated laminar axisymmetric ethene/air diffusion flame under atmospheric pressure is presented. A thermophoretic sampling technique using a variety of probes is employed to obtain data on the morphological character of soot particles collected from various locations of the flame. The morphological features of the particles examined by Transmission Electron Microscopy provide not only qualitative information on particle agglomeration, surface growth, and oxidation

but also quantitative data on primary particle size as a function of flame coordinates.

800,531

PB88-173976

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.

Transport and Growth of Soot Particles in Laminar Diffusion Flames.

Final rept.,

R. J. Santoro, T. T. Yeh, J. J. Horvath, and H. G.

Semerjian. 1987, 27p

Pub. in Combustion Science and Technology 53, n2-3 p89-115 1987.

Keywords: *Diffusion flames, *Soot, Laser applications, Particle size, Reprints.

The formation, growth and burnout of soot particles is examined in a series of ethene/air laminar diffusion flames. Detailed particle, temperature and velocity field measurements are utilized to investigate soot growth along individual particle paths. The importance of changes in the particle residence time, flame geometry and growth rates are evaluated as a function of fuel flow rate. Emphasis is given to the soot volume fraction measurements in two characteristic regions of the flame: the annular region near the flame front where soot is first observed to form, and the center line of the flame. Differences in the temperature-time history along particle paths are discussed, and are related to differences observed in the soot formation processes in these regions. Detailed particle size and number density measurements obtained in these flames are also discussed.

800,532

PB88-175559

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.

Fire in a Room with a Hole: A Prototype Application of the Consolidated Compartment Fire Model (CCFM) Computer Code.

Final rept.,

L. Y. Cooper, and G. P. Forney. 1987, 4p

Pub. in Proceedings of Eastern Section: The Combustion Institute Fall Technical Meeting, National Bureau of Standards, Annual Conference on Fire Research, Gaithersburg, MD., November 2-6, 1987, 4p.

Keywords: Combustion, Computerized simulation, Reprints, *Room fires, CCFM(Consolidated Compartment Fire Model).

A specific objective of compartment fire modeling research activities of the Center for Fire Research is to develop generic and application-specific software for a well-documented, user-friendly, modular and easily updated zone-type Consolidated Compartment Fire Model (CCFM) computer code. The software will then be used to implement different applications of the CCFM capable of simulating a broad range of compartment fire phenomena. The CCFM applications will address a variety of particular needs of CFR and the fire science and technology communities.

800,533

PB88-175567

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.

Computer Model of a Smoldering Cigarette.

Final rept.,

H. Mitter, and W. D. Davis. 1987, 4p

Pub. in Proceedings of Eastern Section: The Combustion Institute, Fall Technical Meeting, National Bureau of Standards, Annual Conference on Fire Research, Gaithersburg, MD., November 2-6, 1987, 4p.

Keywords: *Combustion, Computerized simulation, Reprints, *Cigarettes.

A computer model of a smoldering cigarette is developed. The model consists of partial differential equations to describe thermal and oxygen diffusion and mass conservation as well as a continuity equation, rate equation, Arrhenius equation for the oxidation reaction, and boundary conditions on thermal convection and oxygen diffusion. The equations are cast in the form of the implicit Crank-Nicolson Method and the Gauss-Seidel iterative method with successive over-relaxation is used to solve the resulting non-linear algebraic equations. The model has been used to investigate the effect of changing individual physical parameters on the smoldering velocity of the cigarette.

800,534

PB88-175575

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.

Transient Ceiling Jet Characteristics.

Final rept.,

V. Motevalli, C. H. Marks, B. McCaffrey, and L. Y. Cooper. 1987, 4p

Pub. in Proceedings of Eastern Section: The Combustion Institute, Fall Technical Meeting, National Bureau of Standards, Annual Conference on Fire Research, Gaithersburg, MD., November 2-6, 1987, 4p.

Keywords: *Fire tests, Ceilings(Architecture), Plumes, Jets, Reprints, Room fires.

Measurements of the transient temperature and velocity characteristics of ceiling jets caused by a fire plume impinging on a ceiling are described here. The measurements provide a data base needed to support the development and verification of compartment fire mathematical models, and they are needed in order to optimize the design and location of sprinklers and smoke detectors. Measurements of ceiling-jet temperatures and velocities have been made for fire strengths of 0.5 kW to 2.0 kW and at r/H locations ranging from 0.26 to 2.0. Transient and steady state measurements are reported here for a fiberboard ceiling exposed to a fire plume resulting from a premixed methane-air flame.

800,535

PB88-177308

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.

Letter to the Editor: Fire Technology.

Final rept.,

J. G. Quintiere. 1986, 2p

Pub. in Fire Technology 22, n2 p175-176 1986.

Keywords: *Fire technology.

Response to a Viewpoint by Stephen Winks on USA Fire Research (Fire Technology, 21, 4, November 1985, p327).

800,536

PB88-183967

PC A03/MF A01

California Univ., Berkeley.

Thermal Cracking and Variable Properties Effects on Free Boundary Layer Diffusion Flames,

T. G. Matage. Mar 88, 40p NBS/GCR-88/542

Grant NANTB-5-D0552

Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Diffusion flames, Boundary layer, Cracking(Fracturing), Mathematical models, Convection.

The paper presents an analytical model for a free convective boundary layer diffusion flame, and compares results from this model to experiment. The analytical model will add two new features to the solution presented by Pagni in order to improve agreement with experimental data. It is proposed that the fuel undergoes endothermic decomposition before reaching the flame. The endothermic decomposition of the fuel will be referred to as cracking. The effect of cracking on the free convective diffusion flame is explored by the use of modified Shvab-Zeldovich variables which model both the flame reaction and the cracking reaction. The second addition to the solution given by Pagni is the use of a temperature dependent density-viscosity function which allows the ambient viscosity to be determined by ambient conditions. By using the temperature dependent density-viscosity function, the analytical model accurately predicts the location of the flame using the ambient value of viscosity.

800,537

PB88-192356

(Order as PB88-192331, PC A06)

Technische Univ. Twente, Enschede (Netherlands). Dept. of Informatica.

Computer Controlled Data Acquisition System for Combustion Calorimetric Experiments,

T. J. Buckley, and J. M. Rukkers. 18 Nov 87, 16p

Sponsored by National Bureau of Standards, Gaithersburg, MD.

Pub. in Jnl. of Research of the National Bureau of Standards, v93 n2 p145-160 Mar-Apr 88.

Keywords: *Combustion, *Data acquisition, *Calorimeters, *Controllers, Heat measurement, Scanners,

Voltmeters, *Flow calorimeters, Computer applications, Real time, Computer software.

At NBS a data acquisition system for a flow calorimeter which accommodates large samples has been developed. The system is based on an instrument controller, scanners, and voltmeters, all available commercially. Detectors for temperature, gas flow rate, pressure, and gas chemical composition provide data on key operating parameters of the calorimeter. A real-time, multi-tasking, general-purpose, data acquisition program is described. Computer science concepts important to the design of the program are explained.

800,538

PB88-193891

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Multiphoton Ionization of Methyl Radicals in a Laminar Methane/Air Diffusion Flame.

Final rept.,

P. H. Taylor, and K. C. Smyth. 1985, 4p

Pub. in Proceedings of Fall Technical Meeting on Chemical and Physical Processes in Combustion, Philadelphia, PA., November 4-6, 1985, p8.1-8.4.

Keywords: *Combustion, *Diffusion flames, *Ionization, Methane, Air, *Methyl radicals, Rydberg series.

Methyl radicals are detected in an atmospheric pressure, methane/air diffusion flame by three-photon ionization. The origin band of the transition between the 4s(2)A(2) ground electronic state and the 3p(2)A(2) Rydberg state is observed at 333.5 nm via two-photon excitation. A second peak at 340.8 nm is likely due to both a methyl radical hot band in the same electronic transition and three-photon ionization of carbon atoms produced by photolysis. Spatial profiles are presented as a function of height above the burner and are discussed in terms of resonant and non-resonant ionization processes.

800,539

PB88-193909

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Chemical Production Rates of Intermediate Hydrocarbons in Diffusion Flames: Preliminary Results for Acetylene.

Final rept.,

J. H. Miller. 1985, 4p

Pub. in Proceedings of Fall Technical Meeting on Chemical and Physical Processes in Combustion, Philadelphia, PA., November 4-6, 1985, p11.1-11.4.

Keywords: *Acetylene, *Combustion, *Diffusion flames, Soot.

Concentrations of flame species are combined with mass average velocity and temperature data to calculate net chemical production rates of acetylene in a laminar, methane/air diffusion flame. Acetylene is formed in a region of the flame adjacent to the high temperature reaction zone. Some of the acetylene diffuses into this zone, and is destroyed rapidly. Another destruction zone overlaps a region of the flame where large aromatic molecules (PAH) and soot particles occur.

800,540

PB88-194907

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.

Asymptotic Theory of the Pyrolysis of Char-Forming Materials.

Final rept.,

I. S. Wichman, and A. Atreya. 1985, 4p

Pub. in Proceedings of Fall Technical Meeting on Chemical and Physical Processes in Combustion, Philadelphia, PA., November 4-6, 1985, p44.1-44.4.

Keywords: *Gasification, *Combustion, Pyrolysis, Mathematical models, Numerical analysis, *Chars, *Pyrolysis products.

A theoretical model is developed for the transient, one-dimensional partial gasification of a char-forming material subjected to a constant incident heat flux. The mass vs. time curve is divided into four distinct regimes, each of which is analyzed in detail. Comparisons are made with numerical computations.

800,541

PB88-194915

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.

Integral Analysis of the Equations of Wind-Aided Flame Spread.

Final rept.,

I. S. Wichman, and H. R. Baum. 1985, 4p

Pub. in Proceedings of Fall Technical Meeting on Chemical and Physical Processes in Combustion, Philadelphia, PA., November 4-6, 1985, p54.1-54.4.

Keywords: *Flame propagation, *Combustion, Wind(Meteorology), Mathematical models, *Solid fuels, *Wind effects.

An integral analysis of the problem of wind-aided flame spread over combustible solid fuels is performed. Integral methods analogous to those in fluid mechanics are employed. The objective of the modeling approach is to improve physical understanding of the spreading mechanism by extending the analytical treatment as far as possible. Formulas for various quantities of physical interest are obtained.

800,542

PB88-199005

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Determination of the Input Data for a Model of the Heat Release Rate of Wood.

Final rept.,

W. J. Parker. 1988, 11p

Pub. in Proceedings of Symposium on Mathematical Modeling of Fires and Related Fire Test Methods, New Orleans, LA., December 13, 1986, p105-115 1988.

Keywords: *Wood, *Heat of combustion, *Fires, Cellulose, Mathematical models, Input.

A computer model for the heat release rate of wood is summarized and its input data requirements are specified. Some methods of obtaining these data are discussed. An apparatus for measuring the heat of combustion of the volatiles and the kinetic parameters for the mass loss rate of the various chemical components of wood as a function of their degree of char is described. The results of some of the measurements on cellulose made with this apparatus are presented.

800,543

PB88-200241

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Chemical Production Rates of Intermediate Hydrocarbons in a Methane/Air Diffusion Flame.

Final rept.,

J. H. Miller, W. G. Mallard, and K. C. Smyth. 1986, 9p

Pub. in Proceedings of International Symposium on Combustion/The Combustion Institute (21st), Munich, Germany, p1057-1065 Aug 86.

Keywords: *Combustion, *Reaction kinetics, *Methane, Reaction rates, Acetylene, Butadienes, Benzene, Diffusion flames, Combustion products.

The net production and destruction rates for acetylene, diacetylene, butadiene, and benzene have been determined from measurements of species concentration, temperature, and velocity in a methane/air diffusion flame. In addition, profile measurements of the methyl radical are used to compute profiles of hydrogen atoms. These results provide an initial evaluation of proposed models of hydrocarbon chemical growth routes in diffusion flames, and indicate that the vinyl radical plays a key role in the formation of benzene. Evidence is also presented for acetylene participation in surface growth processes on small soot particles.

800,544

PB88-200266

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.

Time-Dependent Simulation of Small Scale Turbulent Mixing and Reaction.

Final rept.,

H. R. Baum, D. M. Corley, and R. G. Rehm. 1986, 8p Contract AFOSR-ISSA-85-0026

See also PB87-140257. Sponsored by Air Force Office of Scientific Research, Arlington, VA.

Pub. in Proceedings of International Symposium on Combustion/The Combustion Institute (21st), Munich, Germany, p1263-1270 Aug 86.

Keywords: *Combustion, Turbulence, Mathematical models, Fluid dynamics.

COMBUSTION, ENGINES, & PROPELLANTS

Combustion & Ignition

A mathematical model of the local transient diffusion-controlled reaction between initially unmixed species is presented. It is intended ultimately as a computational 'molecule' to be imbedded in direct simulations of larger scale reacting flows. The model consists of an interacting three-dimensional strain vortex field which exactly satisfies the Navier-Stokes equations, an analytically determined Lagrangian representation of the mixing process and convection-diffusion equations for the reacting species in Lagrangian coordinates. The length scale established by the stretching of the vorticity field is shown to be directly relatable to the Kolmogoroff scale if the local strain rate has a scale consistent with laminar boundary layer theory coordinates. Results are shown for the flow pattern and the induced mixing. An analytical solution to the convection-diffusion equation governing the diffusion-controlled reaction is derived. The solution is valid for large Schmidt number and describes the evolution of any initially two-dimensional configuration of reactants.

800,545

PB88-201330 PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Cone Calorimeter Evaluation of the Flammability of Composite Materials,
J. E. Brown, E. Braun, and W. H. Twilley. Mar 88, 69p NBSIR-88/3733
Sponsored by Naval Sea Systems Command, Washington, DC.

Keywords: *Calorimeters, *Composite materials, Extinction, Fiberglass resins, Flammability, Heat release rate, Ignition, Resins, *Cone calorimeters.

A study was undertaken to evaluate the fire performance of composite materials using the cone calorimeter as the bench-scale method of test simulating the thermal irradiance from fires of various magnitudes. Five parameters were derived from the calorimetry measurements to characterize the ignitability and flammability of the composite materials. Three of the parameters are, to a large extent, empirical since radiative heat losses from the samples were unknown. These parameters are: (1) minimum external radiant flux (MERF) required to produce pilot ignition in a pre-determined exposure time; (2) thermal sensitivity index (TSI) which indicates the burning intensity dependence on external heat flux; and (3) extinction sensitivity index (ESI) which indicates the propensity for continued flaming combustion without an external heat flux. MERF values at 300 s for 3 mm composites panels of a FR epoxy resin and a poly(phenylene sulfide) (PPS) resin composites were about 18 and 28 kW/sq. m., respectively.

800,546

PB88-215496 PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Naval Fire Fighting Trainers-Thermal Radiation Effects Associated with the 19F4 FFT,
D. W. Stroup. May 88, 58p NBSIR-88/3755
See also PB86-166196. Sponsored by Naval Training Systems Center, Orlando, FL.

Keywords: *Thermal effects, Fires, Crash fires, Fire fighting, Safety, *Fire models, Aircraft carriers, Wind effects.

The report presents an analysis of the thermal radiation produced by flames from the U.S. Navy 19F4 Fire Fighter Training facility. The 19F4 facility is used to simulate airplane crash fires on aircraft carrier flight decks and aircraft carrying ships. A simple methodology for calculating radiative heat transfer to targets is developed from a review of available literature. Of particular importance is the influence of wind on flame size and shape, the calculation procedure accounts for this effect. The radiation heat fluxes at various distances from the trainer are presented in the form of graphs. The fluxes received by a crane and the 19F4 instructor's tower adjacent to the facility are calculated and shown to be substantial under certain conditions. Recommendations for placement of the crane and the instructor's tower are provided.

800,547

PB88-230511 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.

Integral Analysis of Two Simple Model Problems on Wind-Aided Flame Spread.

Final rept.,
I. S. Wichman, and H. R. Baum. 1988, 5p
Contract USDA-86-FSTY-9-90192
Sponsored by Department of Agriculture, Washington, DC.
Pub. in Jnl. of Heat Transfer 110, n2 p437-441 May 88.

Keywords: *Flames, *Diffusion, *Combustion, Heat transfer, Reprints, Combustion kinetics.

The method of integral analysis is applied to two simple model problems closely related to the general wind-aided flame spread problem. The analysis of the two models strongly suggests approximating the general problem as a steady-state process in the pyrolysis zone and as an unsteady process in the preheat zone ahead of it.

800,548

PB88-239918 PC A05/MF A01
Maryland Univ., College Park.
Fractal Analysis of Soot Agglomerates.
Final rept. Jun 86-Jun 87,
R. J. Samson. Jun 88, 95p NBS/GCR-88/549
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Soot, *Combustion products, Acetylene, Particle size distribution, Smoke, Agglomerates, Computerized simulation, Combustion efficiency, Combustion chambers, Data processing, Particulates, Gas combustion process.

The fractal behavior of soot agglomerates formed by the combustion of acetylene in a coannular diffusion burner is studied. Structural data from electron micrographs were obtained by two methods: the first by particle counting with the aid of stereopairs for small clusters, and the second by electronic digitization with advanced image processing techniques, used for the larger agglomerates. An average agglomerate length to width ratio of about 1.7 with a standard deviation of 0.6 was obtained. The agglomerates were found to have a fractal dimension D of about 1.8-1.9 based on measurements of the pair correlation function for large agglomerates and 1.5-1.6 based on measurements of the radius of gyration for small agglomerates. These results are compared with recent computer simulations as well as experimental studies of inorganic smokes.

800,549

PB88-249966 PC A05/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Hazard Comparison of Fire-Retarded and Non-Fire-Retarded Products.
Special pub. (Final),
V. Babrauskas, R. H. Harris, R. G. Gann, B. C. Levin, B. T. Lee, R. D. Peacock, M. Paabo, W. Twilley, M. Yoklavich, and H. M. Clark. Jul 88, 96p NBS/SP-749
Also available from Supt. of Docs. as SN003-003-02882-7. Library of Congress catalog card no. 88-600560. Sponsored by Fire Retardant Chemicals Association, Lancaster, PA.

Keywords: *Fire hazards, *Flammability testing, Accident prevention, Public health, Safety hazards, Fire safety, Fire prevention, Hazardous materials, Fabrics, Fire resistant coatings, Fire resistant materials, Plastics, Furniture calorimeter, Cone calorimeter, Ion chromatography.

A test program was conducted for the Fire Retardant Chemicals Association to quantify the effects of fire retardant chemicals on total fire hazard. Five different types of products, each made from a different type of plastic were used. The products were made up in analogous fire-retardant (FR) and non-retarded variants (NFR). Cone Calorimeter, Furniture Calorimeter, and NBS combustion toxicity tests were run on the individual products. The test results showed very substantial improvements for the FR products in the areas of increased occupant escape time and decreased production of heat and toxic gas species. The production of smoke was unchanged with the FR products, compared to the NFR ones. It was specifically demonstrated that the overall hazard was reduced, and that reduced burning rates were not obtained at the expense of increasing the hazard due to combustion toxicity. Most of the combustion product effects could be accounted for by the normal gases monitored, and it was also shown that none of the products, either FR or NFR, constituted hazards due to extreme toxic potency.

800,550

PB88-250626 PC A04/MF A01
Trident Engineering Associates, Inc., Annapolis, MD.
Design Concepts for Safer Matches and Lighters,
Aug 88, 63p NBS/GCR-88/550
Contract NBS-2-35999
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fire safety, *Fire prevention, Accident prevention, Public health, Fire hazards, Children, Design criteria, Hazardous materials, Fabrics, *Cigarette lighters, *Matches, Safety hazards.

A match or cigarette lighter is frequently the source of ignition in fires involving the accidental burning of fabric items. Consequently, any design of book matches or lighters which would contribute to their utilization in a safer manner would be highly desirable. In the report, eight design modifications for book matches and seven modifications for cigarette lighters are described and discussed. The objective of the new designs is to prevent the accidental ignition of clothing or other fabric material when used by children in a play situation or when used for a bona fide application by the adult population. The designs proceeded from a study of ignition sequences gleaned from accident reports filed with the National Bureau of Standards. Emphasis was placed on developing a safer match design for the protection of the very young. In order to apply some quantitative index of value, a rating system was devised in which added safety, anticipated acceptance by the public and costs were considered to ascertain the net value of each concept.

800,551

PB89-101653 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Cluster Size Distribution for Free Molecular Agglomeration.
Final rept.,
G. W. Mulholland, R. J. Samson, R. D. Mountain, and M. H. Ernst. 1988, 6p
Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in Jnl. of Energy and Fuels 2, n4 p481-486 1988.

Keywords: *Soot, Agglomerates, Clumps, Particle size distribution, Computerized simulation, Flames, Reprints, Langevin equations, Fractal dimensions, Smoluchowski equation.

The growth of soot agglomerates in a flame was simulated by solving Langevin equations for 8000 spheres in a cubic space with the condition that two particles stick whenever they touch. The particle structures can be characterized with a fractal dimension in the range 1.89-2.07 independent of initial particle density. The exponent χ characterizing the cluster growth kinetics has a value of about 2.0 based on long time analysis including a time offset for initial particle densities of 0.005 particle/(diameter) cubed or less. The cluster size distribution function is found to have a self-preserving form. It is shown that using a kinetic rate kernel based on fractal geometry of soot leads to a size distribution in agreement with the computer simulations.

800,552

PB89-107734 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.
Measurements of Flame Lengths Under Ceilings,
D. Gross. Aug 88, 30p NISTIR-88/3835

Keywords: *Flames, *Flame propagation, *Fire tests, Flame photometry, Combustion, Ceilings, Experimental data, Walls, Measurements, Conduction, Gas burners, *Fire science research.

Measurements of luminous flame extensions beneath ceilings under steady burning conditions are presented. Tests were conducted using both axisymmetric and corner-wall-ceiling configurations for a range of energy supply rates up to 400 kW and burner-to-ceiling heights up to 2.3 m. Flame length observations, which were made both visually and photographically, are expressed in dimensional and in nondimensional terms. Comparisons are made with previous measurements reported in the literature.

800,553

PB89-122402 PC A03/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Room-Temperature Thermal Resistance Measurements of New and Existing Materials for Shipboard Air Duct Systems,

R. R. Zarr, and T. A. Somers. Oct 88, 16p NISTIR-88/3861

Sponsored by David Taylor Research Center, Bethesda, MD.

Keywords: *Flammability testing, *Thermal resistance, *Thermal insulation, Standards, Thermal measurements, Fire protection, Ducts, Marine engineering, Composite materials, Fiberboard, NBS SRM 1450a.

Thermal resistance measurements of conventional and composite material insulation for shipboard air duct systems are described. Conventional shipboard air ducts are constructed of metal walls insulated externally with fibrous-glass board. Composite materials are being considered as replacements for these duct walls. Thermal measurements were conducted using the National Bureau of Standards 1-meter Guarded Hot Plate at a mean temperature of 23.9 degrees C (75 degrees F). Measurements of the fibrous-glass board specimens were within 3% of certified values of NBS SRM 1450a, fibrous-glass board. Measurements of two aramid-fiber honeycomb specimens were approximately one-half the thermal resistance of the fibrous-glass board specimens.

800,554

PB89-126627

PC A05/MF A01

Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.

Radiation from Turbulent Nonluminous and Luminous Diffusion Flames.

Annual rept., Y. R. Sivathanu, M. E. Kounalakis, J. P. Gore, and G. M. Faeth. Oct 88, 92p NIST/GCR-88/553

Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Diffusion flames, Radiant flux density, Luminosity, Turbulence, Laminar flow, Fires, Experimental data, Mathematical models, Combustion, *Radiative heat transfer.

A theoretical and experimental study of the structure and radiation properties of turbulent buoyant diffusion flames is described. The results have application to modeling the fires within structures, materials test methods, fire detection, and effects of materials on fire properties. Issues concerning turbulence-radiation interactions in nonluminous flames and application of laminar flamelet concept to soot volume fractions for heavily sooting flames were addressed. Measurements of transient radiation intensities provided direct experimental evidence of turbulence-radiation interactions. The temporal power spectra of radiation intensity show energy containing and inertial regions similar to other turbulence properties. A stochastic model based on time-series analysis and the laminar flamelet concept was developed and provided encouraging predictions of fluctuating radiation properties.

800,555

PB89-127286

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Heat Transfer Group.

Room-Temperature Thermal Conductivity of Fumed-Silica Insulation for a Standard Reference Material,

R. R. Zarr, T. A. Somers, and D. F. Ebberts. Oct 88, 31p NISTIR-88/3847

Keywords: *Thermal conductivity, *Thermal insulation, Thermal measurements, Temperature, Pressure, Density(Mass/volume), Standards, Test facilities, *Fumed-silica insulation.

Thermal conductivity of fumed-silica insulation board was measured using the National Bureau of Standards 1-meter Guarded Hot Plate. Measurements were conducted for the following range of parameters: bulk density, 304.5 to 325.4 kg/cu m; mean temperature, 283.1 to 311.0 K; and barometric pressure, 97.51 to 103.40 kPa. The effect of moisture content on room-temperature measurements was minimized by prior conditioning of the specimen at 100 deg C for 24 hours. Seventy-five samples (600 by 600 by 25.4 mm) were transferred to the Office of Standard Reference Materials in Gaithersburg, Maryland, USA. The material is offered as a Standard Reference Material having a low thermal conductivity at room-temperature.

800,556

PB89-127302

PC A11/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Summaries of Center for Fire Research (of the National Institute of Standards and Technology) In-House Projects and Grants, 1988,

S. M. Cherry. Nov 88, 230p NISTIR-88/3888
See also PB88-153804.

Keywords: *Research projects, *Combustion, *Fire prevention, Grants, Smoke, Soot, Toxicity, Cellulose, Charring, Flame propagation, *Fire research, Fire models, National Bureau of Standards, National Institute of Standards and Technology.

The report describes the research projects performed in the Center for Fire Research and under its grants program during FY1988.

800,557

PB89-127732

PC A03/MF A01

Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.

Effect of Water on Piloted Ignition of Cellulosic Materials,

A. Atreya, I. S. Wichman, L. S. Tzeng, and M. Abu-Zaid. Oct 88, 46p NIST/GCR-88/552

Grant NANTB-5D0S78

Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Ignition, Flames, Flame propagation, Two dimensional flow, Mathematical models, Numerical analysis, Unsteady flow, One dimensional flow, Water, *Cellulosic materials, Adiabatic flame temperature.

The paper presents a simple theoretical model of the piloted ignition process. The two-dimensional coupled solid and gas phase problem is simplified by assuming that the mass evolution rate from the combustible solid is a known function of time and by employing a plane rather than a point ignition source. These assumptions reduce the model problem to a transient one-dimensional analysis of the gas-phase phenomena. The model equations are solved numerically using a fast scheme especially suited to combustion problems. The pilot flame is modeled as a thin slab of gas that is periodically heated to the adiabatic flame temperature of the stoichiometric mixture. The effects of: (i) the location of the ignition source, (ii) the fuel mass evolution rate from the surface, and (iii) the surface temperature of the solid are investigated. This model adequately explains the pre-ignition flashes that are often observed experimentally. It also provides a rational criterion for positioning of the pilot flame. It is found that the minimum fuel flow rate, by itself is insufficient for predicting the onset of piloted ignition and that heat losses to the surface play an important role.

800,558

PB89-132872

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Science and Engineering Div.

State of Fire Research and Safety.

Final rept.,

J. G. Quintiere. 1988, 14p

Pub. in Proceedings of Fire Safety Science International Symposium (2nd), Tokyo, Japan, June 13-17, 1988, p1-14.

Keywords: *Fire safety, *Fire losses, *Cost analysis, *Meetings, Reviews, Flammability testing, Reprints.

A review is made of available international statistics on the costs and losses due to fire. Estimates are also made on the level of fire research carried out by different countries. Views are presented on strategies for reducing the losses and costs by fire. An example is given to illustrate a rational use of test data to predict fire growth on materials.

800,559

PB89-141089

PC A04/MF A01

Factory Mutual Research Corp., Norwood, MA.

Smoke Point Height and Fire Properties of Materials.

Technical rept.,

A. Tewarson. Dec 88, 51p NIST/GCR-88/555

Grant NANTB-4-D0043

Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fire tests, *Smoking, Heat of combustion, Carbon monoxide, Particles, Combustion efficiency, Fuels, Aliphatic compounds, Alkanes, Alkene compounds, Polymethyl methacrylate, Decomposition, Assessment, Molecular structure, Diffusion flames, Relations(Mathematics), Polymers, Tables(Data).

For engineering calculations in the gas phase, correlations have been established between smoke point heights and heat of combustion and yields of CO and particulates. Smoke point heights reported in the literature were modified such that all the data, including those measured by us, were consistent. Based on the data for 165 fuels from the literature and the data measured by us for 16 fuels, relationships have been suggested for the engineering calculations of heat of complete combustion, chemical heat of combustion and its convective and radiative components, and yields of CO and particulates as functions of the molecular weight for fuels with aliphatic and aromatic, saturated and unsaturated bonds between C and H; C, H and O; C, H, N and C, H and S atoms. The efficiency of combustion decreases with increase in the bond unsaturation and aromatic nature. Substitution of O atoms in the structure increases the efficiency of combustion, whereas substitution of N and S atoms in the structures decreases the efficiency of combustion, S atoms being more efficient than N atoms. The generalized relationships have been used to assess the decomposition, gasification and combustion processes for polymers.

800,560

PB89-141113

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Burning Characteristics of Combat Ship Compartments and Vertical Fire Spread,

D. Gross, and W. D. Davis. Dec 88, 30p NISTIR-88/3897

Contract N00173-88-WR-80284

Sponsored by Naval Research Lab., Washington, DC.

Keywords: *Fire tests, *Combustion, Missile propulsion, Decks(Floor), Computer programs, Propellants, Flame propagation, Heat transfer, Temperature, Combatant ships, *Ship decks, Compartments, FIRST.

This is a report to sponsor summarizing work accomplished under Naval Research Laboratory Contract N0017388WR80284 'Burning Characteristics of Combat Ship Compartments and Vertical Fire Spread.' The computer program FIRST was employed to estimate levels of temperature, energy and heat transfer in burning compartments having features typical of Naval vessels with emphasis on vertical fire spread due to heat transfer through metal decks.

General

800,561

PB88-169776

(Order as PB88-169727, PC A05)

National Bureau of Standards, Gaithersburg, MD.

Application of Flame Spread Theory to Predict Material Performance,

J. G. Quintiere. 1988, 10p

Included in Jnl. of Research of the National Bureau of Standards, v93 n1 p61-70 Jan-Feb 88.

Keywords: *Flammability, Ceilings(Architecture), Walls, Ignition, Heat transfer, Fire tests, Thermal radiation.

A review is presented of recent work which attempts to apply flame spread theories to a wide range of materials. The approach is based on using the theories to develop correlations from material data. The data are derived from small scale tests and are expressed in terms of 'properties'. Various radiant heating apparatus are discussed, and a wide range of results are presented. The focus of the application is fire spread on walls.

800,562

PB88-170196

PC A03/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

COMBUSTION, ENGINES, & PROPELLANTS

General

Suppression of Wood Crib Fires with Sprinkler Sprays: Test Results.
W. D. Walton. Jan 88, 37p NBSIR-88/3696
Sponsored by General Services Administration, Washington, DC.

Keywords: *Fire tests, Sprinklers, Crib, Wooden structures, Particle boards, Plywood, Office buildings.

A series of fire tests was conducted to examine the effect of sprinkler sprays on the burning rate of materials. Tests were conducted on an array of empty cardboard boxes and two sizes of wooden cribs representing light hazard fuel packages. Free burn tests and tests with selected sprinkler sprays applied during the steady burning period were conducted. Free burn heat release rates are compared to heat release rates with sprinkler sprays operating.

800,563
PB88-203799 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Electric Field Effects on Structure in the Continuum.
Final rept.,
D. E. Kelleher, E. B. Saloman, and J. W. Cooper. 1987, 8p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Strategic Defense Initiative Organization, Washington, DC.
Pub. in Photons and Continuum States of Atoms and Molecules, v16 p68-75 1987.

Keywords: *Electric fields, *Ionizing radiation, *Continuum radiation, Resonance, Stark effect, Photons, Atoms, Electromagnetic interference, Molecules, Manifolds, Autoionizing.

The authors have observed electric fields to have pronounced effects on autoionizing resonances in the continuum region above the first ionization threshold. The types of phenomena come under three categories: (I) broadening (and narrowing); (II) interference; (III) 'procreative' Rydberg Stark manifolds.

COMMUNICATION

Common Carrier & Satellite

800,564
PB88-168760 PC A04/MF A01
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
NBS (National Bureau of Standards) Measurement Services: GOES (Geostationary Operational Environmental Satellite) Time Code Dissemination: Description and Operation.
Special pub. (Final),
R. E. Beehler, D. Davis, and J. B. Milton. Jan 88, 52p NBS/SP-250/30
Also available from Supt. of Docs. as SN003-003-02845-2. See also PB84-103522. Library of Congress catalog card no. 87-619906.

Keywords: *Time signals, Frequency measurement, Frequency distribution, Standards, Time measurement, GOES satellites.

The document describes the GOES (Geostationary Operational Environmental Satellite) satellite time code dissemination system operated by NBS to provide time and frequency users with an NBS traceable reference signal for calibration and general timekeeping applications. The discussion includes the various subsystems to generate, monitor, and verify the timing signals located at NBS/Boulder, NOAA/Wallops Island, VA, NBS/Ft. Collins, CO, and several other dispersed sites. Some of the main operational procedures used in providing a close approximation to UTC(NBS) at any user's location in the Western hemisphere are described, along with an analysis of the uncertainties associated with the GOES time code generation, transmission through the satellite path, and reception at the user's site. Techniques and facilities used to maintain internal quality control are also described.

800,565
PB89-118863 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Center for Computer Systems Engineering.
Closing the Gap between OSI (Open Systems Interconnection) Standards and Compatible OSI Products.
Final rept.,
R. P. Blanc. 1986, 4p
Pub. in Computer 19, n3 p97-100 1986.

Keywords: *Standards, *Compatibility, Conformity, Performance tests, Reprints, *National Institute for Standards and Technology, *Computer networks, *Open systems interconnection.

The National Bureau of Standards (NBS) Computer Networking Program devotes itself to helping vendors and users make 'OSI a reality.' The OSI reality is compatible commercial products that can be connected together with a variety of communication technologies and exchange information and work together in a distributed environment. To accomplish this, NBS has organized the NBS Workshop for the Implementers of Open Systems Interconnection where over 100 companies meet to make implementation decisions to facilitate compatible product developments. Second, NBS has laboratory efforts where conformance tests are developed and made available to the industry and used in the development of compatible OSI products. Third, in its laboratories, NBS has developed performance testing methodologies and has applied those tests against different OSI protocols and combinations of OSI protocols to develop objective measures of performance in a variety of environments.

800,566
PB89-119275 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Optical Communication.
Final rept.,
R. I. Scace. 1988, 3p
Pub. in ASTM (American Society for Testing and Materials) Standardization News, p30-32 Sep 88.

Keywords: *Fiber optics, Optical communication, Standards, Trends, Reprints, *Digital systems.

The present status of Optical Fiber communication is reviewed briefly for the non-technical reader. Developments expected in the near future are discussed. Standardization activities are also mentioned.

800,567
PB89-124937 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems Components Div.
FDDI (Fiber Distributed Data Link) Optical Data Link.
Final rept.,
W. E. Burr. 1986, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Communications Magazine 24, n5 p18-23 May 86.

Keywords: *Fiber optics, *Data links, Telecommunications, Standards, Reprints, Token ring architecture, Local area network.

The Fiber Distributed Data Link (FDDI) is a proposed standard for a 100 Mbit/s token ring local area network. The data link specified for FDDI uses 1300 nm LED transmitters, PIN diode receivers and either 62.5/125 or 85/125 graded index multimode optical fiber waveguides at a signalling rate of 125 M baud/s. The total link power budget is 11dB and it is designed for worst case error rates not greater than 1 bit in error in 2.5 X 10 sup 9 transmitted bits through up to 2 km of fiber having a modal bandwidth of at least 400 MHzkm.

800,568
PB89-132773 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Optically Linked Electric and Magnetic Field Sensor for Poynting Vector Measurements in the Near Field of Radiating Sources.
Final rept.,
M. Kanda, and L. D. Driver. 1988, 2p
Pub. in CPEM '88 Digest, p32-33 1988.

Keywords: *Antenna, *Detectors, *Electromagnetic fields, Magnetic fields, Electric fields, Reprints, Electric dipoles, Poynting vector, Fiber optics.

An improved, single-element antenna sensing technique is described which can simultaneously measure the electric (E) field, magnetic (H) field, and time-dependent Poynting vector of electromagnetic (EM) fields. Two RF voltages are produced which, along with relative phase and frequency information, are transmitted to a remotely located vector analyzer by a pair of matched fiber optic downlinks.

Policies, Regulations, & Studies

800,569
PB88-168364 PC A03/MF A01
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
NBS (National Bureau of Standards) Measurement Services: Traceable Frequency Calibrations: How to Use the NBS Frequency Measurement System in the Calibration Lab.
Special pub. (Final),
G. Kamas, and M. A. Lombardi. Jan 88, 46p NBS/SP-250/29
Also available from Supt. of Docs. as SN003-003-02844-4. Library of Congress catalog card no. 87-619905.

Keywords: *Frequency measurement, Radiofrequency oscillators, Radio frequencies, Cesium frequency standards, Crystal oscillators, Quartz resonators, Time interval counters, *Calibration, US NBS, National Bureau of Standards, Loran C, Rubidium oscillators.

A practical approach to making traceable frequency calibrations in the calibration laboratory is discussed. The approach emphasizes obtaining traceable data, keeping appropriate records, and selecting an oscillator and a radio signal to use for calibrations. The NBS Frequency Measurement System is used to illustrate the approach, and to discuss the decisions to be made when setting up a calibration lab for frequency measurements. The theory of frequency measurement is also discussed, with emphasis on using time interval counters to obtain the relative frequency of an oscillator.

800,570
PB88-194931 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Progress Toward One-Nanosecond Two-Way Time Transfer Accuracy Using Ku-Band Geostationary Satellites.
Final rept.,
D. A. Howe. 1987, 8p
Sponsored by Rome Air Development Center, Griffiss AFB, NY.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Ultrasonics, Ferroelectrics, and Frequency Control UFFC-34, n6 p639-646 Nov 87.

Keywords: Frequency stability, Synchronism, Synchronous satellites, Accuracy, Communication satellites, Reprints, *Time transfer, Ku band.

The National Bureau of Standards (NBS) Boulder Laboratory is assembling a system for time transfer with a projected accuracy of 1 ns to locations that can access a Ku-band geostationary communications satellite in common view with Boulder. The system includes a 6.1-m diameter antenna and satellite earth station at Boulder, two transportable earth stations, each with a 1.8-m dish, and modems designed for two-way timing. The elements of the system are described, and a method of using them to achieve high-accuracy time transfer is presented.

800,571
PB89-107155 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Precise Measurement of Time.
Final rept.,
N. F. Ramsey. 1988, 8p
Pub. in American Scientist 76, p42-49 Jan/Feb 88.

Keywords: *Time measurement, Time measuring instruments, Atomic clocks, Time standards, Synchronism, Relativity, History, Reprints.

Policies, Regulations, & Studies

The report provides a brief history of time measurement, including early concepts of periodicity, early designs of clocks, atomic clocks and the international definition of the second, and a discussion of time and relativity.

Verbal

800,572

PB88-194329 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems Components Div.

Performance Assessment for Speech Recognizers.

Final rept.,
D. S. Pallett. 1985, 3p

Pub. in Proceedings of Speech Tech '85. Voice Input/Output Applications Show and Conference, New York, NY., April 22-24, 1985, p162-164.

Keywords: *Speech recognition, Performance tests, Performance evaluation, *Voice communication.

The paper provides introductory material for the Technical Session on Performance Assessment for Speech Recognizers at Speech-Tech '85. It includes a review of factors which are known to influence speech recognizer performance and discusses considerations in developing test procedures.

General

800,573

PB89-141121 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Directory of Organizations and Standards That Affect the Movement of Telecommunications Information for Ten Pacific Rim Countries,

T. N. Troy. Dec 88, 61p NISTIR-88/4015

Keywords: *Directories, *Telecommunication, Regulations, Standards, Organizations, Data, International trade, Telecommunication data, Pacific Rim countries.

The directory contains information on foreign organizations and standards that affect the movement of telecommunications data for ten Pacific Rim countries -- Australia, Hong Kong, Indonesia, Republic of Korea, Malaysia, New Zealand, Philippines, Singapore, Taiwan, and Thailand. The information includes: the name, address, phone, and fax numbers of each national organization having telecom responsibilities; the type of authority assigned to the organization; identification of the law or statute providing the authority; a description of the telecom data flow functions and activities; identification of the significant regulation or standards used; and information concerning standards-related responsibilities, such as licensing, testing, inspection, certification accreditation and registration.

COMPUTERS, CONTROL & INFORMATION THEORY

Computer Hardware

800,574

PATENT-4 764 863 Not available NTIS
Department of Commerce, Washington, DC.

Hardware Interpreter for Finite State Automata.

Patent,
L. J. Silverthorn, P. A. Gaudette, A. W. Holt, G. G. Nacht, and R. B. J. Warner. Filed 9 May 85, patented 16 Aug 88, 29p PB88-245824, PAT-APPL-6-732 327
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

Keywords: *Patents, *Computer systems hardware, *Interpreters, Bus conductors, *Finite state machines, Memory devices, Automata.

Apparatus and method for monitoring transactions on a high speed interface bus and for selectively storing information about such transactions together with the time of such transaction and the state of the automation are described. The apparatus comprises two parallel memories for respectively storing a regular table and a default table, and a memory selector for choosing between the table data of the two memories. The method monitors the interface bus interactions and selectively stores the monitored data and control signals when an analysis of those signals indicate that a transition has occurred. Two parallel, distinct look-up tables store state information and default information and are substantially entered at the same time to provide separate sets of table data. One set of table data is chosen depending upon predetermined criteria.

800,575

PB88-164025 PC A03/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Advanced Systems Div.

Recommended Instrumentation Approaches for a Shared-Memory Multiprocessor,

G. Nacht, and A. Mink. Oct 87, 29p NBSIR-87/3663
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Parallel processors, *Computer systems hardware, Measurement, Instruments, Tracers, Design, Economic analysis, Tools, Tests, *MIMD (Computers), *Multiprocessors, Memory devices, Computer performance evaluation, REMS system, Resource allocation, Cost, TRAMS system.

Two approaches for the design of performance measurement instrumentation for a shared memory, tightly coupled, MIMD multiprocessor are presented. The TRACS Measurement System (TRAMS) is a hybrid measurement tool used to obtain trace measurement information. The Resource Measurement System (REMS) is a non-intrusive hardware measurement tool used to obtain both trace measurement and resource utilization information. The TRAMS approach provides a hardware assist to the more traditional software approach of obtaining timestamps from the operating system at each event to be measured. The hardware assist reduces the artifact that is introduced in a test program and is a feasible and economical approach to providing measurement capabilities to a wide range of multiprocessors. Manufacturers could offer this type of measurement tool as a plug-in option. The REMS approach provides more detailed and extensive measurement information than does the TRAMS approach and introduces no artifact to the test program, but it does this at a significantly higher cost. When access to pertinent signals is restricted the applicability of such a hardware tool is limited.

800,576

PB88-215520 PC A03/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Advanced Systems Div.

Parallel Processing Benchmarks,
G. E. Lyon. Jun 87, 36p NBSIR-87/3580
See also PB87-137196. Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Computer performance, Evaluation, Measurement, Metrics, Models, *Benchmarks, Frameworks, *Parallel processing.

This is a summary of preliminary work and experiences at NBS on benchmarks for parallel machines. Discussion covers the several roles that benchmarks play, ideal and realistic settings, and quick reviews of several types of benchmark sets. Several recommendations can be forwarded, given the rudimentary nature of parallel processor characterization: (1) That the performance metrics be embedded in more comprehensive frameworks that can be appraised and modified as needed; (2) That one universal framework is beyond reach, since distinct clusters of use are emerging with separate emphases; (3) That large application bench-

marks are most successful when they run well on a machine--and thus demonstrate success for a narrow class; (4) That to programmers, the value of smaller metrics (fragments of code) is more diagnostic and preventive than predictive. Small metric sets should encourage the parametric study of architectures and applications, and thereby promote both economical hardware enhancement and suitable program design.

800,577

PB89-113542 PC A03/MF A01
National Inst. of Standards and Technology (ICST), Gaithersburg, MD. Advanced Systems Div.

Performance Evaluation and Analytic Modeling of Shared-Memory Computers,

J. R. Nechvatal. Sep 88, 30p NISTIR-88/3857
Sponsored by Office of Export Administration, Washington, DC.

Keywords: *Computers, Performance evaluation, *Mathematical models, Networks, Guidelines, Surveys, *Exports, *Computer models, *Computer systems performance, Analysis, Memory devices, Parallel computers, Computer architecture.

The report surveys and discusses analytic performance models for shared-memory computers. The purpose is to assess these models to determine if they are relevant to the task of assisting the Office of Export Administration in establishing guidelines for exports of computers. The focus of the study is on the assumptions made by modelers regarding interconnection networks and memory access patterns exhibited by applications. The great majority of models concentrate on analyzing a small collection of networks. Furthermore, most modelers make strong assumptions regarding the independence and uniform distribution of memory accesses. The consequences of these assumptions in the resulting models are noted.

800,578

PB89-114052 PC A03/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Center for Computer Systems Engineering.

Simple Multiprocessor Performance Measurement Techniques and Examples of Their Use,

A. Mink, J. W. Roberts, J. M. Draper, and R. J. Carpenter. Jul 86, 20p NBSIR-86/3416, ARPA-5520
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Performance evaluation, Measurement, Graphs(Charts), *Multiprocessors, *Hardware, National Institute of Standards and Technology, Parallel computers.

The report describes simple hardware measurement techniques for the measurement of the performance of multiprocessor computers. A number of examples of data obtained using the techniques are reported, as well as an indication of the timing accuracy obtainable with the approach.

Computer Software

800,579

PB88-168331 PC A12/MF A01
National Bureau of Standards, Gaithersburg, MD.

Computer Science and Technology: Stable Implementation Agreements for Open Systems Interconnection Protocols. Version 1, Edition 1. December 1987. Based on the Proceedings of the NBS (National Bureau of Standards) Workshop for Implementors of OSI Held at Gaithersburg, Maryland. Special pub. (Final),
R. Rosenthal. Jan 88, 257p NBS/SP-500/150
Also available from Supt. of Docs. as SN003-003-02838-0. Library of Congress catalog card no. 88-600500.

Keywords: Computer networks, Tests, Protocols, *Open systems interconnections, *Interconnection protocols, National Bureau of Standards.

The document records current Stable Agreements for Open Systems Interconnection Protocols among the organizations participating in the NBS/OSI Workshop Series for Implementors of OSI Protocols.

COMPUTERS, CONTROL & INFORMATION THEORY

Computer Software

800,580
PB88-169446 PC A03/MF A01
National Bureau of Standards, Gaithersburg, MD.
Reference Model for DBMS (Database Management System) User Facility.
E. N. Fong, J. Gersting, K. Kinsley, N. McDonald,
and J. North. Jan 88, 39p NBSIR-88/3709
See also PB85-225217.

Keywords: Standardization, Interfaces, "Data base management systems, "Man computer interface, "Data base languages, End use, Software tools.

In the report the authors present a reference model for the user facility portion of a database management system. The User Facility Reference Model offers a separation between the Data Management Tools and the User. The User Data Language and the Internal User Data Language are candidates for 'standardization'. Since the Data Management tool layer is continually evolving and current technology often embeds a user interface in each tool, the process of 'standardization' must be staged. The work here indicates that the User Data Language can provide a focus for the start of the process. The report also provides a theoretical basis from which a User Data Language could be developed.

800,581
PB88-169545 PC A05/MF A01
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Using the Information Resource Dictionary System Command Language (Second Edition),
A. Goldfine. Jan 88, 84p NBSIR-88/3701
Supersedes PB85-227783.

Keywords: "Information systems, "Data base management systems, "Command languages, "Data dictionaries, Information Resource Dictionary System, IRDS system.

The document introduces and provides examples of the Command Language of the Information Resource Dictionary System (IRDS). A dictionary maintained by the U.S. Air Force is defined in the IRDS and used as a continuing example throughout the document. The dictionary is populated, manipulated, and reported on using the precise syntax of the Command Language. An appendix to the document provides a complete listing of the creation of the example. Other appendices provide indices of all command appearances and all clause appearances.

800,582
PB88-192471 PC A03/MF A01
National Bureau of Standards, Gaithersburg, MD.
Scheme for Translating Control Flow in the C Programming Language to Grafset with Examples,
B. H. Thomas. Mar 88, 31p NBSIR-88/3741

Keywords: "Translator routines, Control sequences, "C programming language, "Grafset programming language, Parallel processing, Computer graphics, C codes.

The purpose of the paper is to show a translation scheme from control flow in the C programming language to the Grafset language. Grafset is a graphical language for expressing control flow. Grafset is used to design parallel systems such as in a manufacturing environment. The control constructs covered in the paper are: conditional statement; while; do; for; switch; break; continue; goto; label; and null. The Grafset used in the paper is the language, as augmented by Savoir. The C programming language is the one described by Kernighan and Ritchie. The translation is to be used as a reference for programmers to translate existing C source code into Grafset.

800,583
PB88-193289 PC A04/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Information Systems Engineering Div.
Computer Science and Technology: Knowledge-Based System for Physical Database Design.
Special pub. (Final).
C. E. Dabrowski, and D. K. Jefferson. Feb 88, 62p NBS/SP-500/151
Also available from Supt. of Docs. Library of Congress catalog card no. 88-600502.

Keywords: Computer design, "Knowledge based systems, "Data bases, Computer systems design.

A knowledge-based system for physical database design has been developed at the Institute for Com-

puter Sciences and Technology. The system processes large multi-entity databases with complex workload requirements and identifies near-optimal physical designs. It employs heuristics developed by physical design experts and cost modeling algorithms to reduce the large number of design alternatives available in large complex problems to a few select designs. The system is implemented in Lisp.

800,584
PB88-215405 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD.

Guide to Software Reliability Measurements.

Final rept.,
P. B. Powell. 1984, 1p
Pub. in Proceedings of Institute of Electrical and Electronics Engineers Computer Society's International Computer Software and Applications Conference (8th), Chicago, IL. November 7-9, 1984, p527-528.

Keywords: Measurement, Guidelines, "Computer program reliability, "Software engineering, "Computer software.

The paper is a short description of the background and contents of the guide for software reliability measurements. It is being developed under the auspices of the IEEE.

800,585
PB88-225644 PC A03/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Computer Science and Technology: Management Guide to Software Reuse.
Special pub. (Final),
W. Wong. Apr 88, 41p NBS/SP-500/155
Also available from Supt. of Docs as SN003-003-02858-4. See also PB87-109856. Library of Congress catalog card no. 88-600528.

Keywords: Productivity, Risks, Specifications, Economic analysis, "Reusable software, "Software quality control, "Software engineering, "Computer program portability, Computer software, Costs.

The document, the second in a series on software reuse, focuses on the improvement of productivity and quality of software as well as the reduction of software risks. Software reusability can provide substantial economic benefits. Initial reusability efforts should emphasize an understanding of the concept of software reuse, and encourage the use of existing well-developed software specifications, designs, methods, techniques, tools, and other reusable information. The report presents general management guidance in software reuse. While there is no magic solution to the problem of achieving the goals of software reuse, the report discusses various aspects, problems, issues, and economic reasons of software reuse, and identifies those techniques and characteristics which will assist management in improving software reuse.

800,586
PB88-228259 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Building Maintainable Software.
Final rept.,
W. M. Osborne. 1987, 15p
See also PB88-228333.
Pub. in Computer Programming Management, p1-15 1987.

Keywords: "Computer programming, Management, Planning, Guidelines, Reprints, "Computer software maintenance, "Software engineering, National Bureau of Standards.

Maintainability is the ease with which software can be changed to satisfy user requirements or corrected when deficiencies are detected. System maintainability must be considered throughout the system's life cycle. If the software is designed and developed initially with maintenance in mind, it can be more readily changed without undue degradation of system effectiveness. The article provides guidelines for building maintainability into a system. Article 15-05-95 discusses the implementation of a software maintenance management plan to help sustain software maintainability.

800,587
PB88-228333 Not available NTIS

National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Sustaining Software Maintainability.
Final rept.,
W. M. Osborne. 1987, 10p
See also PB88-228259.
Pub. in Computer Programming Management, p1-10 1987.

Keywords: "Computer programming, Management, Planning, Project management, Systems management, Reprints, "Computer software maintenance, "Software engineering, National Bureau of Standards.

Although system maintainability should be the goal of all systems personnel, it is the primary responsibility of software maintenance managers. They are responsible for making decisions regarding the performance of software maintenance, priority assignment of the requested work, estimation of the level of effort for a particular task, progress tracking, and assurance that all phases of the maintenance effort adhere to system standards. Their task is substantially easier when a software maintenance management plan, described in the article, is available.

800,588
PB88-238761 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Advanced Systems Div.
Tagless Marking That is Linear over Subtrees.
Final rept.,
G. Lyon. 1988, 6p
Pub. in Information Processing Letters 27, n1 p23-28 1988.

Keywords: Graph theory, Trees(Mathematics), Algorithms, Marking, Reprints, "Computer storage management.

A new tagless marking algorithm traverses and marks nodes of a directed binary graph, initiating tests for cycles only as need arises. Because trees do not trigger any tests, the algorithm takes linear time on any graph subtree.

800,589
PB89-101448 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
GAMS (Guide to Available Mathematical Software): A Framework for the Management of Scientific Software.
Final rept.,
R. F. Boisvert, S. E. Howe, and D. K. Kahaner. 1986, 43p
Pub. in ACM Transactions on Mathematical Software 11, n4 p313-355 Dec 85.

Keywords: "Mathematical programming, Classifications, Reprints, "Data base management systems, "Computer software, Guide to Available Mathematical Software, U.S. NBS.

The Guide to Available Mathematical Software (GAMS) is a classification scheme, a data base system, and a printed catalog. GAMS provides a framework for both the scientist-end-user and the librarian-maintainer to deal with large quantities of mathematical and statistical software. The paper describes GAMS and its use at the National Bureau of Standards.

800,590
PB89-109508 PC A08/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Common Memory for the Personal Computer.
Research rept.,
S. Rybczynski. 11 Aug 88, 158p NISTIR-88/3838

Keywords: Computer programs, Computer architecture, "Shared memory, "Interprocessor communication, National Institute of Standards and Technology, IBM-PC computers, C programming language, Common memory, Automated Manufacturing Research Facility.

The Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards is using an architecture called 'common memory' (also known as shared memory) for interprocess communication. The document describes the shared memory concept and defines the shared memory architecture as implemented on the IBM Personal Computer (or compatible)

using the DOS operating system. A complete shared memory software library has been written using the C programming language to maximize portability to other systems. A sample program demonstrating the use of the common memory environment is included in the software distribution.

800,591
PB89-118004 PC A03/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
User's Guide for SETKY-GETKY: A Keyed Access System for the HP1000.
Interim rept.,
D. Bickham, and D. Neumann. Oct 86, 31p NBSIR-86/3417

Keywords: Manuals, *Access methods, *HP1000 computers, *SETKY-GETKY System, TEXED document processor.

SETKY-GETKY is a keyed access system written for the HP1000 mini-computer. It performs two major functions: (1) makes the help system on the computer more user-friendly by providing a quick and easy way for the users to obtain help information on requested topics and (2) provides keyed access to free formatted textual or tabular material. Some of the special features available with the system include the ability to transfer automatically between key files and the option of inserting run commands in the indexed data files. The SETKY-GETKY system is completely compatible with TEXED, the document processor available on the CSL Library distributed by INTEREX, The International Association of Hewlett-Packard Computer Users. This has the advantage that a user can produce a keyed online help system for the HP1000 and also a text-edited user's guide from the same data file by inserting both SETKY commands and TEXED commands in the file.

800,592
PB89-122394 PC A03/MF A01
National Bureau of Standards, Gaithersburg, MD.
GRAMPS (General Real-Time Asynchronous Multi-processor System) Operating System: User's Guide.
P. Mansbach, and M. Shneier. Sep 88, 43p NBSIR-88/3776
Prepared in cooperation with Philips Labs., Briarcliff Manor, NY.

Keywords: *Operating systems(Computers), Asynchronous computers, *Multiprocessors, *General Real-time Asynchronous Multi-Processor System, User manuals(Computer programs), Distributed processing, Computer applications, Computer communications.

The guide describes the GRAMPS real-time multi-processor operating system from an applications viewpoint. It presents the information needed to use GRAMPS in implementing distributed processing applications. Additional information needed by an administrator to set up and maintain a specific application appears in the Administrator's Guide.

800,593
PB89-123889 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Center for Computer Systems Engineering.
NBS (National Bureau of Standards) Program in Open Systems Interconnection (OSI).
Final rept.,
R. P. Blanc. 1987, 11p
Pub. in Lecture Notes in Computer Science 248, p27-37 1987.

Keywords: *Standards, Tests, Development, Performance tests, Reprints, *Computer networks, *Open Systems Interconnection(OSI).

The NBS Program in Open Systems Interconnection (OSI) has as objectives to define OSI specifications that meet Government and industry requirements, champion those specifications as international standards, and assist industry in implementing those standards as commercial products. The NBS effort goes through a cycle with six phases: (1) Research in OSI networking technology, (2) Specification development based on the research, (3) Standards negotiation through the national and international voluntary process, (4) Development of implementable specifications leading to product specifications, (5) Test method development, and (6) Product development. There are six laboratories that contribute to the OSI work. The six

are for conformance testing, formal test method and automated tools development, performance measures to increase the applicability of OSI, local networking conformance and performance testing, DoD gateway development, and security architectures. Initial laboratory work in selected areas of network management including internetworking, naming, addressing, and distributed directory services is also beginning.

800,594
PB89-127112 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Recursion Theoretic Approach to Program Testing.
Final rept.,
J. C. Cherniavsky, and C. H. Smith. 1987, 8p
Pub. in IEEE (Institute of Electrical and Electronic Engineers) Transactions on Software Engineering SE-13, n7 p777-784 Jul 87.

Keywords: *Computer programming, *Tests, Recursive routines, Reprints, *Software engineering, Inference, Induction.

Inductive inference, the automatic synthesis of programs, bears certain ostensible relationships with program testing. For inductive inference, one must take a finite sample of the desired input/output behavior of some program and produce (synthesize) an equivalent program. In the testing paradigm, one seeks a finite sample for a function such that any program (in a given set) which computes something other than the object function differs from the object function on the finite sample. In both cases, the finite sample embodies sufficient knowledge to isolate the desired program from all other possibilities. These relationships are investigated and general recursion theoretic properties of testable sets of functions are exposed.

Control Systems & Control Theory

800,595
PB89-128870 PC A17/MF A01
National Institute of Standards and Technology (NIST), Gaithersburg, MD. Robot Systems Div.
NBS (National Bureau of Standards) Real-Time Control System User's Reference Manual (Version 2.2C).
Technical note (Final),
S. A. Leake, and R. D. Kilmer. Oct 88, 382p NIST/TN-1250
Also available from Supt. of Docs. as SN003-003-02879-7.

Keywords: *Automatic control, SMACRO programming language, FORTH programming language, *Control systems, *Real time systems, *Robots, Applications programs (Computers), Hierarchies, User manuals(Computer programs), Robotics, Computer architecture, US NIST.

The NBS-developed Real-Time Control System(RCS) is a hierarchically-structured controller designed to use sensory feedback for real-time control of automated systems. The manual describes the basic structure of RCS and the programming features available to develop application software. In addition to a detailed description of the structure of RCS, examples illustrating the use of RCS for the control of robotic systems are presented.

Information Processing Standards

800,596
FIPS PUB 130 PC E20
National Bureau of Standards, Gaithersburg, MD.
Intelligent Peripheral Interface (IPI). Category: Hardware Standard, Subcategory: Interface.
Federal information processing standards publication (Final),
W. E. Burr. c16 Jul 87, 491p
Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available, North American Continent price \$7.00; all others write for quote.

Keywords: *Auxiliary equipment(Computers), *Standards, *Controllers, *Bus conductors, *Magnetic disks, Interfaces, Specifications, *Host computers, *Parallel processing, *Optical disks, *Federal information processing standards, *Mass storage, Cost engineering, Life cycles.

The standard defines the functional, electrical, and mechanical specifications for a 16-bit parallel master/slave bus interface, suitable for connecting a host computer or controller to mass storage peripherals. The standard also provides the following command set specifications: (a) Device Specific Command Set for magnetic Disk Drives; (b) Device Generic Command Set for Magnetic and Optical Disks; (c) Command Set for Generic Tape; The standard facilitates plug-to-plug interchangeability of storage equipment as a part of computer systems. The Government's intent in employing this standard is to reduce the cost of satisfying its data processing requirements through increasing its available alternative sources of supply for computer systems components at the time of initial system acquisition, as well as in system replacement and augmentation and in system component replacement. This standard is also expected to lead to improved reutilization of system components.

800,597
FIPS PUB 131 PC E10
National Bureau of Standards, Gaithersburg, MD.
Small Computer System Interface (SCSI). Category: Hardware Standard, Subcategory: Interface.
Federal information processing standards publication (Final),
W. E. Burr. c16 Jul 87, 225p
Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available, North American Continent price \$7.00; all others write for quote.

Keywords: *Auxiliary equipment(Computers), *Data processing equipment, *Printers, *Standards, *Magnetic disks, *Data storage, Interfaces, Specifications, *Optical disks, *Magnetic tape, *Parallel processing, *Federal information processing standards, *Mass storage, *Read only memories, *Data storage systems, *Small Computer System interface, *Disk recording systems, Cost engineering, Life cycles.

The standard defines the functional, electrical, and mechanical specifications for an 8-bit parallel bus, suitable for connecting physically small computers to each other and to mass storage peripherals. It also defines the operational specifications (command sets) for the following devices: (a) Sequential-Access Devices (e.g., magnetic tape); (b) Direct-Access Devices (e.g., magnetic disks); (c) Printer Devices; (d) Write-once Read Multiple Devices (e.g., optical disks); (e) Read-Only Direct-Access Devices (e.g., read only optical disks); (f) Processor Devices; The Government's intent in employing this standard is to reduce the cost of satisfying its data processing requirements through increasing its available alternative sources of supply for computer system components at the time of initial system acquisition, as well as in system replacement and augmentation and in system component replacement. The standard is also expected to lead to improved reutilization of system components.

800,598
FIPS PUB 132 PC E07
National Bureau of Standards (ICST), Gaithersburg, MD.
Guideline for Software Verification and Validation Plans. Category: Software. Subcategory: Validation, Verification, and Testing.
Federal information processing standards publication (Final),
D. R. Wallace. c19 Nov 87, 34p
Three ring vinyl binder also available, North American price \$7.00; all others write for quote.

Keywords: *Standards, Tests, Validation, Guidelines, *Computer program verification, *Computer software, *Federal information processing standards, Life cycles, Formats.

The Guideline announces the adoption of the Standard for Software Verification and Validation Plans (ANSI/IEEE Standard 1012-1986) as a Federal Information Processing Standards Publication Guideline. ANSI/IEEE 1012 provides uniform and minimum requirements for the format and content of software verification and validation plans. It defines minimum tasks, inputs, and outputs for critical software (software

COMPUTERS, CONTROL & INFORMATION THEORY

Information Processing Standards

whose failure could have an impact on safety or could cause large financial or social losses) and optional tasks; it recommends these for other software. It includes minimum requirements for test tasks and documentation. It provides direction for the management, procedural administration, and reporting for software verification and validation. This Guideline is for use by software acquirers, software managers, developers, verifiers, testers, maintainers, and end users.

800,599
FIPS PUB 4-1 PC A02
National Bureau of Standards, Gaithersburg, MD.
Representation for Calendar Date and Ordinal Date for Information Interchange.
Federal information processing standards publication (Final).
R. G. Saltman. c1986, 9p
Supersedes FIPS PUB 4. Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available, North American Continent price \$6.25; all others write for quote.

Keywords: *Standards, *Information systems, Computers, Data processing, *Calendar date, Federal Information Processing Standards, *Ordinal date, Data interchange.

The standard provides a means of representing calendar data and ordinal date to facilitate interchange of data among information systems. This standard adopts American National Standard ANSI X3.30-1985, Representation for Calendar Date and Ordinal Date for Information Interchange. This revision supersedes FIPS PUB 4 in its entirety.

800,600
FIPS PUB 46-1 PC A03/MF A01
National Bureau of Standards, Gaithersburg, MD.
Data Encryption Standard. Category: ADP Operations, Subcategory: Computer Security.
Federal information processing standards publication (Final).
D. Branstad. 22 Jan 88, 20p
Supersedes FIPS PUB 46.
Three ring vinyl binder also available, North American Continent price \$7.00; all others write for quote.

Keywords: *Data processing security, *Cryptography, *Secure communications, *Electronic security, *Standards, *Data encryption, *Cryptography, *Computer security, *Federal Information Processing Standards, *Computer information security.

The selective application of technological and related procedural safeguards is an important responsibility of every Federal organization in providing adequate security to its ADP systems. The publication provides a standard to be used by Federal organizations when these organizations specify that cryptographic protection is to be used for sensitive or valuable computer data. Protection of computer data during transmission between electronic components or while in storage may be necessary to maintain the confidentiality and integrity of the information represented by that data. The standard specifies an encryption algorithm which is to be implemented in an electronic device for use in Federal ADP systems and networks. The algorithm uniquely defines the mathematical steps required to transform computer data into a cryptographic cipher. It also specifies the steps required to transform the cipher back to its original form. A device performing this algorithm may be used in many applications areas where cryptographic data protection is needed. Within the context of a total security program comprising physical security procedures, good information management practices and computer system/network access controls, the Data Encryption Standard is being made available for use by Federal agencies. The revision supersedes FIPS 46.

800,601
FIPS PUB 58-1 PC A03
National Bureau of Standards, Gaithersburg, MD.
Representations of Local Time of Day for Information Interchange.
Federal information processing standards publication (Final).
R. G. Saltman. c1986, 19p
Supersedes FIPS PUB 58. Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available, North American Continent price \$6.25; all others write for quote.

Keywords: *Standards, *Information systems, National government, Day, Time, Computers, Data process-

ing, *Federal information processing standards, *Time of day.

The standard provides uniform time representations based upon both the 12- and 24-hour timekeeping systems. It provides a means for representing local time of the day in digital form for the purpose of interchanging information among data systems. It specifies the time elements and their sequencing, the use of separators between time elements and the representation of the meridiem designator. The standard adopts American National Standard ANSI X3.43-1986, Representations of Local Time of Day for Information Interchange. This revision supersedes FIPS PUB 58 in its entirety.

800,602
FIPS PUB 68-2 PC E15
National Bureau of Standards (ICST), Gaithersburg, MD.
BASIC. Category: Software Standard. Subcategory: Programming Language.
Federal information processing standards publication (Final).
M. Vickers. c28 Aug 87, 372p
Supersedes FIPS-PUB-68-1.
Three ring vinyl binder also available, North American Continent price \$7.00; all others write for quote.

Keywords: *Computer programming, National government, Standards, Programming languages, Semantics, *BASIC programming language, *Federal information processing standards, Language programming, Software engineering, Time sharing.

The publication announces the adoption of American National Standard for BASIC, ANSI X3.113-1987, as a Federal Information Processing Standard (FIPS). This FIPS supersedes FIPS PUB 68-1, Minimal BASIC, and reflects major changes, improvements, and additions to the BASIC specifications. The American National Standard for BASIC, ANSI X3.113-1987, specifies the form and establishes the interpretation of programs expressed in the BASIC programming language. The purpose of the standard is to promote portability of BASIC programs for use on a variety of data processing systems. FIPS BASIC is suitable for use in relatively simple applications, especially those with a high degree of user interaction. The features of BASIC support use by nonprofessional programmers, i.e., those whose primary skill is not programming, who may need to write their own programs.

800,603
PB88-163779 PC A07/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD.
Technical Overview of the Information Resource Dictionary System (Second Edition).
A. Goldfine, and P. Konig. Jan 88, 138p NBSIR-88/3700
Supersedes PB85-224491.

Keywords: Standardization, Specifications, *Data dictionary, *Computer software, *International standards, *Federal information processing standards, *Information Resource Dictionary system, *Data base management, *IRDS system, *Information management, *Software tools.

The publication provides a technical overview of the computer software specifications for an Information Resource Dictionary System (IRDS). It summarizes the data architecture and the software functions and processes of the IRDS. The data dictionary system is a key computer software tool for the management of data and information resources. It provides facilities for recording, storing and processing descriptions of an organization's significant data and data processing resources. The IRDS Specifications are an American National Standard, a U.S. Federal Information Processing Standard, and a Draft Proposal within the International Organization for Standardization (ISO). The Overview also provides background information on the development of the IRDS software specifications.

800,604
PB88-173901 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.
Significant Network Standards.
Final rept.,
J. R. Moulton. 1985, 6p
Pub. in Telecommunications 19, n3 6p Mar 85.

Keywords: *Computer networks, *Standards, *Telecommunications, Reprints, Open systems interconnections.

There has been an explosion of standardization in computer networking technologies. The paper briefly describes the developing and existing network standards. The descriptions are organized by the layers of the ISO Open Systems Interconnection Basic Reference Model.

800,605
PB88-194337 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.
Simulation of an International Standard Transport Protocol.
Final rept.,
K. Mills, M. Wheatley, and R. Colella. 1985, 8p
Pub. in Proceedings of International Conference on the Management and Performance Evaluation of Computer Systems CMG '85, Dallas, TX., December 9-13, 1985, p306-313.

Keywords: *Standards, Simulation, Protocols, Spacecraft communication, *Transport protocol, *International standards, *Computer networks.

The paper describes a simulation model of an international standard transport protocol. The model has been applied to several simulation experiments in support of the Institute for Computer Sciences and Technology protocol performance research program. The results of a simulation experiment to evaluate alternate acknowledgement strategies are reported. A discussion of model validation is included and a short description of future work is provided.

800,606
PB88-216645 PC A04/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Information Systems Engineering Div.
Standards Conformance Testing: Issues and Activities.
Rept. for 1980-87,
S. J. Kemmerer. May 88, 61p NBSIR-88/3768
See also PB86-169349.

Keywords: *Certification, *Standards, Administration, Validation, Test methods, Procedures, Suites, *Conformance testing, Laboratory accreditation, Federal Information Processing Standards.

The NBSIR suggests a process to follow when developing a conformance testing program for appropriate NBS/ICST Federal Information Processing Standards (FIPS). These FIPS and the standards they are promoting are implemented into software products for commercial use. A consistent application of testing processes and specific test suites will help align commercial products to conform to these standards. Application of such a testing process will become more critical as Federal agencies begin to request procurement of software implementing these standards.

800,607
PB88-222864 PC A03/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Advanced Systems Div.
Benchmarks to Supplant Export 'FPDR' (Floating Point Data Rate) Calculations.
D. Bailey, E. Brooks, J. Dongarra, A. Hayes, M. Heath, and G. Lyon. Jun 88, 20p NBSIR-88/3795
Prepared in cooperation with National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center, Lawrence Livermore National Lab., CA., Argonne National Lab., Evanston, IL., and Los Alamos National Lab., NM.

Keywords: *Computers, *Performance evaluation, Bench marks, Parallel processors, Scalars, *Exports, *Technology transfer, Floating point arithmetic, Data rate, Vector processing, Multiprocessors.

Because modern computer architectures render application of the FPDR (Floating Point Data Processing Rate) increasingly difficult, there has been increased interest in export evaluation via actual system performances. The report discusses benchmarking of uniprocessor (usually vector) machines for scientific computation (SIMD array processors are not included), and parallel processing and its characterization for export control.

800,608
PB88-223441 PC A04/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD.

Computer Science and Technology: Message Authentication Code (MAC) Validation System; Requirements and Procedures.

Special pub. (Final),
M. Smid, E. Barker, D. Balenson, and M. Haykin.
May 88, 53p NBS/SP-500/156
Also available from Supt. of Docs. Library of Congress catalog card no. 88-600533.

Keywords: *Banking, *Finance, *Data processing security, *Cryptography, *Standards, Protocols, Validation, Requirements, Procedures, *Message authentication, *Computer security, *Data integrity, *Cryptography, *Federal information processing standards, *Message processing, American National Standards Institute, Financial Institution Message Authentication, *MAC system, *Electronic funds transfer.

The National Bureau of Standards Message Authentication Code (MAC) Validation System (MVS) tests message authentication devices for conformance to two data authentication standards: Federal Information Processing Standard Publication (FIPS PUB) 113, Computer Data Authentication, and American National Standards Institute (ANSI) X9.9-1986, Financial Institution Message Authentication (Wholesale). The MVS is designed to perform automated testing on message authentication devices which are remote to NBS. The publication provides brief overviews of the two data authentication standards and introduces the basic design and configuration of the MVS. The requirements and administrative procedures to be followed by those seeking formal NBS validation of a message authentication device are presented. The requirements described include the specific protocols for communication between the message authentication device under test (DUT) and the MVS, the types of tests which the DUT must pass for formal NBS validation, and general instructions for accessing and interfacing to the MVS. An appendix with examples illustrating the MVS testing protocol is provided.

800,609
PB88-243175 PC A05/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD.

Ongoing Implementation Agreements for Open Systems Interconnection Protocols. Volume 2. Continuing Agreements.

R. Rosenthal. Jul 88, 88p NBSIR-88/3824

See also Volume 1, PB88-243183.

Keywords: *Computer networks, Protocols, Tests, Standards, Meetings, Agreements, *Foreign technology, *Open systems interconnections, *Local area networks, OSI, Message processing, Secure communications.

The document records current agreements on implementation details of Open Systems Interconnection Protocols among the organizations participating in the NBS/OSI Workshop Series for Implementors of OSI Protocols. These decisions are documented to facilitate organizations in their understanding of the status of agreements. This is a standing document that is updated after each workshop (about 4 times a year).

800,610
PB88-243183 PC A08/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD.

Ongoing Implementation Agreements for Open Systems Interconnection Protocols. Volume 1. Stable Virtual Terminal and Document Architecture and Interchange Format.

R. Rosenthal. Jul 88, 164p NBSIR-88/3823

See also Volume 2, PB88-243175 and PB88-153713.

Keywords: *Computer networks, Protocols, Tests, Standards, Documents, Data transmission, Meetings, Agreements, *Foreign technology, *Open systems interconnections, *Local area networks, OSI, Virtual terminals, Communication terminals, Office document architecture.

The document records current agreements on implementation details of Open Systems Interconnection Protocols among the organizations participating in the NBS/OSI Workshop Series for Implementors of OSI Protocols. These decisions are documented to facilitate organizations in their understanding of the status of agreements. This is a standing document that is updated after each workshop (about 4 times a year).

800,611
PB89-107742 PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Hyperstandard: Applying Hypertext Technology to Standards Development, Dissemination and Implementation.
S. P. Ressler. Sep 88, 19p NISTIR-88/3859

Keywords: *Standards, Development, Prototypes, *Information processing, Hypertexts, CD-ROM.

A Hyperstandard is proposed which uses several existing computing technologies combined in a novel way to address a number of problems in the development and implementation of standards. A hypertext document is created which consists of a collection of 'inter-connected writings'. The implementor or researcher would browse through the document and upon encountering some point of interest could follow that point and travel along its connections to find other (cross referenced) points in that collection of writings. Rather than limiting these 'documents' to pure text the authors may, given present technology, also incorporate graphics, audio and computer programs into the content of the document creating what is known as a hypermedia document. Hypertext technology is shown to be applicable to the various facets of developing and delivering information processing standards. Combined with the increasingly available CD-ROM optical storage technology, a new medium for delivering entire databases of standards, their related documents and software to aid in their implementations is a realistic goal.

800,612
PB89-126999 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.

Application Layer Communication Protocols for Building Energy Management and Control Systems.

Final rept.,
S. T. Bushby. 1988, 16p

Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v94 p12 16p 1988.

Keywords: *Standards, Requirements, Reprints, *Energy management, *Management systems, Energy conservation, Open Systems Interconnection.

The requirements for an industry standard communication protocol for energy management and control systems (EMCS) are discussed in terms of the International Organization for Standardization's (IOS) Open Systems Interconnection (OSI) Basic Reference Model with emphasis on the application layer. The information exchange requirements of commonly used control strategies are analyzed to develop a list of the minimum application level services required for an industry standard. This list was augmented to include additional desirable services, based on several years of experience building and operating an EMCS at the National Bureau of Standards. Two public EMCS protocols, believed to be representative of the current state of commercially available EMCS, are described and analyzed to determine their ability to meet the application service requirements developed and their compatibility with the OSI Reference Model. Both protocols were found to meet the minimum requirements, but neither provides all of the services considered desirable. Neither protocol was found to be compatible with the OSI model.

800,613
PB89-132351 PC A09/MF A01
National Bureau of Standards, Gaithersburg, MD.

Ongoing Implementation Agreements for Open Systems Interconnection Protocols. Volume 2.1. Continuing Agreements.

T. Boland. Oct 88, 190p NBSIR-88/3824-1

See also Volume 2, PB88-243175. Proceedings of the NIST/OSI Implementor's Workshop Plenary Assembly, held in Gaithersburg, MD. on August 26, 1988.

Keywords: *Computer networks, Protocols, Tests, Standards, Meetings, Agreements, *Open Systems Interconnections, *Local area networks, OSI, Message processing, Communications.

The document records current agreements on implementation details of Open Systems Interconnection Protocols among the organizations participating in the NIST/OSI Workshop Series for Implementors of OSI Protocols. These decisions are documented to facilitate organizations in their understanding of the status of agreements. This is a standing document that is updated after each workshop (about 4 times a year).

Pattern Recognition & Image Processing

800,614

PB88-175260 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.

Free-Field Propagation of Localized Pulses.

Final rept.,

E. Marx. 1985, 3p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Antennas and Propagation AP-33, n10 p1149-1151 Oct 85.

Keywords: Reprints, Computer programs, *Electromagnetic field of propagation, *Finite light pulses, Energy density.

Incident transient fields obey homogeneous Maxwell equations and are assumed to be a known input to the integral equations of electromagnetic scattering. These fields can be specified by two solenoidal fields for E and B at the initial time, and they can be computed at other times using the Green function for the scalar wave equation. Equations are derived that are then used in a computer program to do the integrations over the information-collecting sphere. Sample calculations show that a modulated pulse keeps its shape much better than a simple pulse.

800,615
PB88-175286 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.

Hierarchical Cellular Logic and the PIPE Processor: Structural and Functional Correspondence.

Final rept.,

E. W. Kent, and S. L. Tanimoto. 1985, 9p

Pub. in Proceedings of IEEE (Institute for Electrical and Electronics Engineers) Computer Society Workshop on Computer Architecture for Pattern Analysis and Image Database Management, Miami Beach, FL., November 18-20, 1985, p311-319.

Keywords: *Image processing, *Hierarchical vision, Machine vision, Multi resolution, Parallel computers, Pyramids.

HCL is a hierarchical cellular logic, in which operations are applied to objects called bit-pyramids which themselves are functions on spaces called hierarchical domains. HCL provides an algebra for computations involving hierarchical, multiple-resolution representations of image data. PIPE is a newly-developed parallel architecture which supports multiple-resolution pyramid operations. The paper establishes that HCL is functionally equivalent to a subset of PIPE's instruction set, and that every HCL primitive operation corresponds to a single machine instruction in PIPE and executes in a single machine cycle. Further, the connectivity of HCL data-objects is embedded in the data-paths of the PIPE architecture. Thus, PIPE can operate upon the data-objects of HCL directly, without using extra storage for links or pointers, and without computation of storage addresses.

800,616
PB88-238704 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems Components Div.

Automated Fingerprint Identification Standard and Performance Benchmarks.

Final rept.,

R. T. Moore. 1988, 8p

Pub. in Proceedings of International Forensic Symposium on Latent Prints, Quantico, VA., July 7-10, 1987, p83-90 1988.

Keywords: *Identification systems, *Standards, Algorithms, Bench marks, Reliability, *Automated fingerprint processing, *Fingerprint classifications, *AFIS systems, *Automatic Fingerprint Identification System, *Computer program reliability, *Data conversion, Computer software.

The coordinate systems and metrics used by some of the Automatic Fingerprint Identification Systems (AFIS) are described. These differ in significant ways. Thus, the direct interchange of fingerprint information between different AFIS is not possible without the use of conversion algorithms. An ANSI data format standard was developed to support the interchange of fingerprint information between these systems. Using it, each AFIS needs only a single software package to

COMPUTERS, CONTROL & INFORMATION THEORY

Pattern Recognition & Image Processing

interchange fingerprint related data with any of the other systems. Performance benchmarks are another area in which AFIS related standards development work is underway. Two methods are described for using benchmark tests for evaluating the reliability and selectivity of AFIS.

800,617

PB88-239777

PC A04/MF A01

National Bureau of Standards, Gaithersburg, MD.
NBS (National Bureau of Standards) Vision System in the AMRF (Automated Manufacturing Research Facility).

Final rept.,

M. Nashman, and K. J. Chaconas. Dec 87, 51p

NBSIR-87/3684

Keywords: *Real time operations, Computer programs, Manuals, *Image processing, *US NBS Automated Manufacturing Research Facility, Workstations, Computer aided manufacturing.

The document describes the NBS Vision System in the AMRF. It discusses the objectives of the vision system and its applications in the factory environment. Since the vision system is a multi-processor system, each process is described according to its position in the vision hierarchy as well as to its particular logical and computational functions. The unique hardware used is discussed and its capabilities described. In addition, a guide to operations is included: This contains step-by-step directions for 'bringing up' the system in either stand-alone mode or integrated mode. The interfaces between the individual processes of the vision system, as well as the interfaces between the vision system and other AMRF systems, are described. Finally, appendices are included which describe data structures, and debugging features.

800,618

PB89-124093

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

LISP-Based Image Analysis System with Applications to Microscopy.

Final rept.,

D. S. Bright. 1987, 37p

Pub. in Jnl. of Microscopy 148, pt1 p51-87 Oct 87.

Keywords: *Algorithms, Fortran, Microanalysis, Reprints, *Image processing, *Image analysis, LISP programming language.

LISPX is an image processing and analysis system consisting of a sub-system of commands implemented in FORTRAN and a collection of algorithms implemented in LISP. Examples are given of using the system for microanalysis applications. The commands are useful alone for simple image processing tasks. For image analysis applications, the LISP programming environment for which the commands are designed, allows rapid development of algorithms and a convenient way to use them. Appendices contain definitions of the most useful commands and examples of the LISP algorithms.

General

800,619

PB88-187737

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.

Deconvolution in Slow Motion and the Experimental Determination of the Impulse Response of a Linear Time Invariant System.

Research rept.,

A. S. Carasso. 1987, 20p

Sponsored by Army Research Office, Research Triangle Park, NC.

Pub. in Institute of Mathematics and Its Applications Conference Series 'Mathematics in Signal Processing', p193-212 1987.

Keywords: Cauchy problem, Linear systems, Central limit theorem, *Signal processing, Time invariant systems, Impulse response, Deconvolution.

The class of one sided infinitely divisible probability density functions includes a rich variety of multimodal (C sup infinity symbol) approximations to the Dirac delta-function. When such pulses are used as probe

waveforms in linear time invariant systems, the output waveform is an approximation to the system's impulse response in which the singularities have been smoothed out. Such singularities are usually of vital interest in characterizing the linear system. The ill-posed deconvolution problem for the output waveform aims at reconstructing the singularities in the presence of noise. The infinite divisibility of the probe pulse plays a key role in such singular reconstruction problems, by allowing reformulation of the Volterra integral equation as a Cauchy problem for a linear parabolic pseudo differential equation in two independent variables. In turn, this leads to the concept of regularized partial deconvolution for which strong error bounds can be obtained, in the (L sup infinity symbol) norm, under (L sup 2) a-priori constraints on the data noise and on the unknown system response.

800,620

PB88-190186

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.

Efficient Algorithm for the Brownian Dynamics Simulation of Aggregation.

Final rept.,

F. Sullivan, and R. D. Mountain. 1986, 7p

Pub. in Computer Physics Communications 42, n1 p43-49 Sep 86.

Keywords: Simulation, Molecular dynamics, Reprints, *Computer algorithm, *Aggregation.

Computer simulation techniques have proven to be quite useful for studying the structure of particulates produced by the process of growth through the aggregation of smaller particles. In the paper the authors introduce an efficient algorithm for use in the computer simulation of the kinetics of the growth of particulates. The new algorithm is based on sorting and data structures for set manipulations. Computer tests indicate that running time is reduced by a factor of four as compared to 'conventional' methods.

800,621

PB89-124929

Not available NTIS

National Bureau of Standards (ICST), Gaithersburg, MD. Systems Components Div.

Considerations for Security in the OSI (Open Systems Interconnection) Architecture.

Final rept.,

D. K. Branstad. 1987, 6p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Network Magazine 1, n2 p34-39 Apr 87.

Keywords: Networks, Authentication, Protection, Reprints, *Computer information security, *Computer privacy, *Open Systems Interconnection(OSI), Data integrity.

Security is becoming an important topic in considerations of implementations of Open Systems Interconnection (OSI) architecture. The paper addresses a wide range of security goals in OSI. It discusses a set of security services that are being considered for implementation of OSI and selects five as high priority for initial implementation. These five are: (1) Protection of data against unauthorized modification; (2) Protection of data against undetected loss/repetition; (3) Protection of data against unauthorized disclosure; (4) Verification of the identity of a sender of data; (5) Verification of the identity of a receiver of data. The National Bureau of Standards had a program in network security for several years. An OSI security test bed has been implemented in an NBS laboratory to evaluate different approaches of implementing security in OSI. The paper summarizes the results of this research and recommends additional work for the future.

800,622

PB89-129514

PC A04/MF A01

National Inst. of Standards and Technology (ICST), Gaithersburg, MD. Security Technology Group.

Computer Science and Technology: Smart Card Technology: New Methods for Computer Access Control.

Special pub. (Final),

M. E. Haykin, and R. B. J. Warnar. Sep 88, 53p

NIST/SP-500/157

Also available from Supt. of Docs. Library of Congress catalog card no. 88-600577.

Keywords: Integrated circuits, Identification systems, Biometrics, Authentication, *Smart cards, *Computer security, *Access control, Fingerprints, Microcomputers, Read only memories.

A smart card is a credit-card-sized device containing one or more integrated circuit chips, which perform the functions of a microprocessor, memory, and an input/output interface. Smart cards, and other related devices, may be used to provide an increased level of security in applications requiring controlled access to sensitive information. The publication describes the basic components of a smart card, and the goals and obstacles of smart card application development. Possible roles for smart cards in modern computer security systems and research conducted at the National Bureau of Standards (NBS) in the area of smart card access control systems are discussed. A forecast is made for the characteristics and applications of future smart cards and related devices. An overview of current standards activities for smart cards is given in an appendix.

DETECTION & COUNTERMEASURES

Electromagnetic & Acoustic Countermeasures

800,623

PB88-178827

PC A05/MF A01

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

EMR (Electromagnetic Radiation) Test Facilities Evaluation of Reverberating Chamber Located at RADC (Rome Air Development Center), Griffiss AFB (Air Force Base), Rome, New York.

M. L. Crawford, G. H. Koepke, and J. M. Ladbury.

Dec 87, 78p NBSIR-87/3080

Sponsored by Rome Air Development Center, Griffiss AFB, NY.

Keywords: *Electromagnetic radiation, *Test facilities, Vulnerability, Weapon systems, Reverberation.

The report describes measurement procedures and results obtained from evaluating the reverberating chamber facility located at the Rome Air Development Center (RADC), Griffiss Air Force Base, Rome, New York. The facility was developed by the RADC for use in measuring and analyzing the electromagnetic susceptibility/vulnerability (EMS/V) of weapon systems and the shielding effectiveness of enclosures and shielding materials. A brief description of the facility, including the instrumentation used for performing its evaluation and calibration by the National Bureau of Standards (NBS), is given.

ELECTROTECHNOLOGY

Antennas

800,624

PB88-227764

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Near-Field Gain of a Horn and an Open-Ended Waveguide: Comparison between Theory and Experiment.

Final rept.,

M. Kanda, and R. D. Orr. 1987, 8p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Antennas and Propagation AP-35, n1 p33-40 Jan 87.

Keywords: *Horn antennas, *Antennas, *Waveguides, Comparison, Gain, Reprints, Near field, Ultrahigh frequency.

Generating a standard electromagnetic field requires knowledge of the gain of the transmitting antenna. The

theory and supporting experimental measurements of the near-field gain of a pyramidal horn and an open-ended waveguide (OEG) at 450 MHz are given. The empirical near-field gain for the OEG is derived from experimental results obtained by a two-antenna method at about 2 GHz. The theoretical near-field gain for the rectangular pyramidal horn is derived from Schelkunoff's formula. Two independent near-field gain measurements of these antennas are made using a three-antenna method and a transfer-standard-probe method. The discrepancy between theoretical and experimental results is typically less than + or - 1 dB.

800,625
PB88-227806 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.

Near-Field Gain of a Horn and an Open-Ended Waveguide: Comparison between Theory and Experiment.

Final rept.,
M. Kanda, and R. D. Orr. 1986, 4p
Pub. in Proceedings of International Symposium Digest - Antennas and Propagation, Philadelphia, PA., June 8-13, 1986, p91-94.

Keywords: *Horn antennas, *Antennas, *Waveguides, Comparison, Gain, Near field, Ultrahigh frequency.

The paper gives the theory and supporting experimental measurements for the near-zone gain of a rectangular pyramidal horn and an open-ended waveguide (OEG) at 450 MHz. The empirical near-zone gain for the OEG is derived from experimental results obtained by a 2-antenna method at about 2 GHz. The theoretical near-zone gain for the rectangular pyramidal horn is derived from Schelkunoff's formula. Two independent near-zone gain measurements of these antennas are made using a three-antenna method and a transfer-standard-probe method. The discrepancy between theoretical and experimental results is typically less than + or - 1 dB.

800,626
PB88-227848 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.

Near-Field Gain of a Horn and an Open-Ended Waveguide: Comparison between Theory and Experiment.

Final rept.,
M. Kanda, and R. D. Orr. 1987, 9p
Pub. in Proceedings of International Conference on Electromagnetic Compatibility (5th), York, England, October 1-3, 1986, p137-145 1987.

Keywords: *Horn antennas, *Antennas, *Waveguides, Comparison, Gain, Near field, Ultrahigh frequency.

The paper gives the theory and supporting experimental measurements for the near-field gain of a rectangular pyramidal horn and an open-ended waveguide (OEG) at 450 MHz. The empirical near-field gain for the OEG is derived from experimental results obtained by a two-antenna method at about 2 GHz. The theoretical near-field gain for the rectangular pyramidal horn is derived from Schelkunoff's formula. Two independent near-field gain measurements of these antennas are made using a three-antenna method and a transfer-standard-probe method. The discrepancy between theoretical and experimental results is typically less than + or - 1 dB.

800,627
PB89-107114 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.

Three PC-Computer Programs for Antenna Calculations Primarily for Use Below 1000 MHz.

Final rept.,
R. G. FitzGerrell. 1987, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Antennas and Propagation Society Newsletter 29, n3 p30-32 Jun 87.

Keywords: *Antennas, *Measurement, *Computer software, Dipoles, Amplification, Field strength, Fortran 77 programming language, IBM PC/XT computers, Site attenuation.

The article describes three computer programs used frequently by the author when working on various antenna measurement projects in the frequency range below 1000 MHz. These programs were originally written in FORTRAN4 and run on various main-frame

computers at the NBS Boulder Laboratories. During the last year, they were converted, essentially intact, to FORTRAN77 and compiled using IBM Professional FORTRAN installed on an IBM PC/XT. As a result of the choice of compilers, a math coprocessor is required (8087 for the XT) to run the *.EXE files.

800,628
PB89-107122 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.

Monopole Impedance and Gain Measurements on Finite Ground Planes.

Final rept.,
R. G. FitzGerrell. 1988, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Antennas and Propagation 36, n3 p431-438 Mar 88.

Keywords: *Monopoles, *Impedance, *Amplification, Models, Scale(Ratio), Measurement, Insertion loss, *Finite ground plane.

The possibility of making 'acceptably accurate' input impedance and gain measurements of monopoles on a reduced size ground plane is explored. Ideally, monopoles are located on an infinite perfectly conducting ground plane. Existing measured and calculated data show that the diameter of a highly conducting ground plane should be at least wavelengths, for measuring the input impedance of 0.25 wavelength monopoles. At 25 MHz, the lowest frequency considered here, such a ground plane would require a space at least 48 m in diameter. Model impedance measurements and calculations presented here imply that a space only 10 by 11 m is required by using 16 resistively loaded wire radials to extend a 3.66 by 4.88-m rectangular aluminum ground plane. Measured insertion loss data acquired using a 1:5 scale model ground plane with resistively loaded radials indicate that it is sufficiently large for gain measurements as well. Measured and calculated monopole SWR and insertion loss on a full-scale ground plane verify the results of the model measurements.

800,629
PB89-118954 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.

Displacement Errors in Antenna Near-Field Measurements and Their Effect on the Far Field.

Final rept.,
L. A. Muth. 1988, 11p
See also PB87-134375.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Antennas and Propagation 36, n5 p581-591 May 88.

Keywords: *Antennas, *Electromagnetic fields, *Displacement, Errors, Far field, Reprints.

The effects of probe displacement errors in the near-field measurement procedure on the far-field spectrum are studied. Expressions are derived for the displacement error functions that maximize the fractional error in the spectrum both for the on-axis and off-axis directions. The x-y and z-displacement errors in planar scanning are studied first and, consequently, the results are generalized to errors in spherical scanning. Some simple near-field models are used to obtain order of magnitude estimates for the fractional error as a function of relevant scale lengths of the near field, defined as the lengths over which significant variations occur.

800,630
PB89-137699 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.

NBS (National Bureau of Standards) Calibration Procedures for Horizontal Dipole Antennas (25 to 1000 MHz).

Final rept.,
D. G. Camell, E. B. Larsen, and W. J. Anson. 1988, 5p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Electromagnetic Compatibility, Seattle, WA., August 2-4, 1988, p390-394.

Keywords: *Dipole antennas, *Calibrating, Horizon, Standards, Electromagnetic fields, Field strength, Anechoic chambers, Reprints.

The theoretical basis and test procedures for calibrating horizontally polarized dipole antennas at the Na-

tional Bureau of Standards will be discussed. Two different techniques and two different test sites are used. In the standard antenna method a field strength level is calculated from the response of a simple half-wave dipole. The method is used at an open field site in the frequency range of 25 to 1000 MHz. In the standard field method the theoretical gain equations of waveguides and horn antennas are used to determine the field strength level. This latter method is used in an anechoic chamber in the frequency range of 200 to 1000 MHz. Procedures for both techniques are explained and measurement setups are illustrated. Measurement uncertainties are discussed.

Circuits

800,631
PB88-192455 PC A07/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Electrical Performance Tests for True-RMS Voltmeters.
R. S. Turgel, O. B. Laug, and T. E. Leedy. Mar 88, 132p NBSIR-88/3736
Sponsored by Army Communications-Electronics Command, Fort Monmouth, NJ.

Keywords: *Voltmeters, *Performance tests, Electronics, Specifications, Tests, Electrical measurement, Analog to digital converters, Army.

Electrical performance test procedures for a true-rms voltmeter were developed by the National Bureau of Standards for the U.S. Army Communications-Electronics Command. The report provides detailed, step-by-step test procedures that are based on the specifications supplied by the Army for the purpose of evaluating the bid samples of this type of instrument. Examples are provided of the data sheets and tables for recording of interim data and the final results. The report discusses the philosophy underlying each of the measurement procedures from a point of view of the basic metrology required to perform the measurements. In addition, the sources of measurement error are discussed.

800,632
PB88-194998 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Time and Frequency Div.

Precise Phase Noise Measurements of Oscillators and Other Devices from 1 MHz to 20 GHz.

Final rept.,
F. L. Walls. 1986, 273p
Pub. in Proceedings of Quartz Devices Conference and Exhibition (8th), Kansas City, MO., August 26-28, 1986, 273p.

Keywords: Oscillators, Amplifiers, Multipliers, Dividers, Microwave equipment, Medium frequencies, High frequencies, Very high frequencies, Ultrahigh frequencies, Superhigh frequencies, Electrical measurement, *Phase noise, Calibration.

In the talk, the commonly used measures of phase noise are briefly defined, and their relationships are explained. Techniques for making precise measurements of phase noise in oscillators, multipliers, dividers, amplifiers, and other components are discussed. Particular attention is given to methods of calibration which permit accuracies of 1 dB or better to be achieved. Common pitfalls to avoid are also covered.

800,633
PB88-217286 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Surge-Protective Devices.

Final rept.,
F. D. Martzloff, and L. M. Levinson. 1988, 31p
Pub. in Electronic Ceramics, Chapter 5, p275-305 1988.

Keywords: *Circuit protection, *Surges, *Varistors, Zinc oxides, Ceramics, Reprints.

The chapter presents an overview of surge protection, starting with the occurrence and nature of surges. Next, the effect of these surges on equipment is briefly discussed, showing the need for protection. A review is then presented of the various approaches previously

ELECTROTECHNOLOGY

Circuits

or currently used, showing where zinc oxide varistors offer improved characteristics.

800,634
PB88-217690 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Technology Div.
Superconducting Analog Track-and-Hold Circuit.
Final rept.,
D. Go, C. A. Hamilton, F. L. Lloyd, M. S. Diiorio, and
R. S. Withers. 1988, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices 35, n4
p498-501 Apr 88.

Keywords: Superconductors, Reprints, *Track-and-hold circuits, SQUID (Detectors).

A superconducting analog track-and-hold circuit has been designed, fabricated, and tested. Experimental results demonstrate a 1.2-GHz bandwidth and a 25-dB dynamic range. Model calculations indicate that an optimized circuit with a critical current density of 10,000 A/sq cm can achieve a 4-GHz bandwidth and a 35-dB dynamic range.

800,635
PB88-238324 PC A09
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
NBS (National Bureau of Standards) Measurement Services: A Calibration Service for 30 MHz Attenuation and Phase Shift.
Special pub. (Final),
R. T. Adair, and D. H. Russell. Apr 88, 188p NBS/SP-250/32
Also available from Supt. of Docs. Library of Congress catalog card no. 88-600527. Portions of this document are not fully legible.

Keywords: *Coaxial filters, *Calibrating, Microwave filters, Radiofrequency filters, Phase shift, Engineering drawings, Standards, Electromagnetic wave transmission, Attenuation, Error analysis, Manuals, Tables(Data), Graphs(Charts), *US NBS Attenuation Measurement System.

A calibration service currently being offered by NBS for attenuation and phase shift at 30 MHz is described. The service offers measurements on coaxial attenuators that are either fixed (standard attenuation) or variable for incremental (step) attenuation. Waveguide-below-cutoff variable attenuators with coaxial connectors are also calibrated for incremental attenuation. Ranges of capabilities and estimated limits of systematic and random uncertainty are presented. Calibration of phase shifters which provide fixed (insertion) phase shift and those with variable phase shift (phase shift difference) is described. Definitions, capabilities of the system and techniques of calibration are given. The standards, measurement uncertainties, results from intercomparisons quality assurance and statistical control of the system are discussed and analyzed. Representative reports of calibration are also included.

800,636
PB88-239553 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Calculable, Transportable Audio-Frequency AC Reference Standard.
Final rept.,
N. Oldham, P. Hetrick, and Z. Xiangren. 1988, 2p
Pub. in CPEN '88 Digest, p46-47 1988.

Keywords: *Waveform generators, *Standards, Audio frequencies, Alternating current, Reprints, *Reference standards, Transportable.

A transportable ac voltage source is described, in which sinusoidal signals are digitally-synthesized in the audio-frequency range. The rms value of the output waveform may be calculated by measuring the dc level of the individual steps used to generate the waveform. The uncertainty of the calculation is typically + or - 10 ppm from 20 Hz - 10 kHz at the 7 V level.

800,637
PB89-123368 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Two Dimensional Top Hat Filter for Extracting Spots and Spheres from Digital Images.
Final rept.,
D. S. Bright, and E. B. Steel. 1987, 10p
Pub. in Jnl. of Microscopy 146, p12 p191-200 May 87.

Keywords: *Filters, Electron diffraction, Photomicrographs, Reprints, *Image processing, *Digital data.

A filter is described that selects rounded objects or spots from digital images. Examples of its use are given for isolating electron diffraction spots and for isolating particles in transmission light micrographs.

Electromechanical Devices

800,638
PB88-239462 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Equivalent Circuit for Imperfect Transmission Line Connectors.
Final rept.,
C. A. Hoer. 1988, 2p
Pub. in CPEN '88 Digest, p264-265 Jun 88.

Keywords: *Electric connectors, *Transmission lines, *Equivalent circuits, Network analyzers, Calibrating, Microwave equipment, Reflection, Scattering, Reprints.

An exact equivalent circuit for a pair of imperfect transmission line connectors is developed. New reference planes are chosen in such a way that all imperfections in the connector pair can be lumped into one connector or the other. This makes it possible to calibrate out imperfections in test port connectors when calibrating network analyzers.

Optoelectronic Devices & Systems

800,639
PB88-175088 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Pulse Waveform Standards for Electro-Optics.
Final rept.,
R. A. Lawton. 1985, 2p
Sponsored by Optical Society of America, Washington, DC., and Institute of Electrical and Electronics Engineers, Inc., Washington, DC.
Pub. in Proceedings of Topical Meeting Picosecond Electronics and Optoelectronics, Lake Tahoe, NV., March 13-15, 1985, p205-206.

Keywords: *Waveform generators, *Electrooptics, *Standards, Sampling, Picosecond pulses.

The development of reference waveform generators for transfer of pulse measurement accuracy from the National Bureau of Standards to the electro-optic sampler is described.

800,640
PB88-176797 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Stable, High Quantum Efficiency, UV-Enhanced Silicon Photodiodes by Arsenic Diffusion.
Final rept.,
R. Korde, and J. Geist. 1987, 4p
Pub. in Solid-State Electronics 30, n1 p89-92 1987.

Keywords: *Photodiodes, Quantum efficiency, Silicon, Arsenic, Diffusion, Ultraviolet radiation, Reprints.

Very high quantum efficiency, UV-enhanced silicon photodiodes have been developed by arsenic diffusion into p-type silicon as an alternative to the inversion layer photodiodes commonly used in precise radiometric and spectroscopic measurements. The fabricated diodes had an unbiased internal quantum efficiency that was 100% from 350 to 550 nm, and that exceeded 100% at shorter wavelengths. A typical responsivity at 200 nm was 0.1 A/W. No degradation in responsivity was detected anywhere in the 200-1100 nm range when these devices were exposed to 20 mW/sq cm of 254 nm radiation for 60 days. Thus the theoretical maximum value of internal quantum efficiency for a diffused photodiode appears to have been achieved in the UV and short wavelength visible, without compromising the diode's long term stability. This is in marked contrast to older types of diffused photodiodes, which either were 'dead' in the UV, or exhibited a spectral

response vs flux characteristic that changed considerably with UV exposure.

800,641
PB88-187505 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Photodiode Quantum Efficiency and Spectral Responsivity Self-Calibration.
Final rept.,
J. Geist. 1987, 5p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Instrumentation and Measurement Technology Conference, Boston, MA., April 27-29, 1987, p75-79.

Keywords: *Radiometry, *Photodiodes, *Standards, Quantum efficiency, Silicon, Visible radiation, Calibration.

High-quality silicon photodiodes can be used as primary radiometric standards in the visible portion of the electromagnetic spectrum. The physical basis for their use as standards and their performance in areas pertinent to their use as standards is reviewed.

Power & Signal Transmission Devices

800,642
PB88-188545 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Technology Div.
Effect of Transverse Compressive Stress on the Critical Current and Upper Critical Field of Nb3Sn.
Final rept.,
J. W. Ekin. 1987, 6p
Contract DE-AI01-84ER52113
Sponsored by Department of Energy, Washington, DC.
Office of Fusion Energy.
Pub. in Jnl. of Applied Physics 62, n12 p4829-4834, 15 Dec 87.

Keywords: *Superconducting magnets, *Critical field, *Stresses, Compressive properties, Reprints, *Niobium stannides, *Superconducting wires, *Critical current.

A large reversible degradation of the critical current of multifilamentary Nb3Sn superconductors has been observed when uniaxial compressive stress is applied transverse to the conductor axis at 4 K. In bronze-process multifilamentary Nb3Sn, the onset of significant degradation occurs at about 50 MPa. In an applied field of 10 T, the magnitude of the effect is about seven times larger for transverse stress than for stress applied along the conductor axis. The transverse stress effect will need to be considered in the internal design of large magnets because of the greater sensitivity of Nb3Sn to transverse stress. It is shown that the transverse stress from the Lorentz force on the conductor is proportional to conductor thickness. This will place limits on conductor dimensions and the spacing between distributed reinforcement in large magnets. The effect may be particularly significant in cabled conductors where large transverse stress concentrations can occur at strand crossover points.

800,643
PB88-188552 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Technology Div.
Transverse Stress Effect on Multifilamentary Nb3Sn Superconductor.
Final rept.,
J. W. Ekin. 1988, 6p
Contract DE-AI01-84ER52113
Pub. in Advances in Cryogenic Engineering Materials, v34 p547-552 1988.

Keywords: *Stresses, *Superconducting magnets, Compressive properties, Reprints, *Niobium stannides, *Critical current, *Superconducting wires.

A large reversible degradation of the critical current of multifilamentary Nb3Sn superconductors has been observed under the application of uniaxial compressive stress applied transverse to the conductor axis at 4 K. In bronze-process multifilamentary Nb3Sn, the onset of significant degradation occurs at about 50 MPa. The intrinsic effect of transverse stress on the upper critical field is about ten times greater than for axial stress.

Although transverse stress on the Nb₃Sn filaments is less than axial stress in most applications, it will need to be considered in the internal stress design of large magnets because of the greater sensitivity of Nb₃Sn to transverse stress. The effect scales with conductor thickness and this will place limits on conductor dimensions and the spacing between distributed reinforcement in large magnets.

800,644

PB88-194881

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Conductors for Advanced Energy Systems.

Final rept.,

F. R. Fickett, and T. E. Capobianco. 1987, 54p

See also PB84-223429. Sponsored by International Copper Research Association, Inc., New York.

Pub. in INCRA (International Copper Research Association) Annual Report, n321B p1-45 Oct 87.

Keywords: *Electric wire, *Copper, Magnetoresistivity, Electrical resistance, Yield strength, Stability, Cryogenics, Reprints.

The authors present the results of extensive mechanical properties tests on a large number of oxygen-free copper samples representing a range of producers and wire tempers. Both room temperature and liquid helium (4 K) tests are reported. A specialized apparatus developed for the low temperature tests is described. Results of the many tests are presented in graphical and tabular form. The most interesting of the results is that it appears possible to predict the strength of oxygen-free copper wires at low temperatures by the measurement of the residual resistance ratio (RRR), the ratio of the room temperature resistance to that measured at 4 K. This result is of great importance in applications, as many laboratories are able to measure RRR, but few can do low temperature mechanical properties tests.

800,645

PB88-239470

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Determination of Scattering Parameters from Precision Coaxial Air-Line Standards.

Final rept.,

D. R. Holt. 1988, 1p

Pub. in CPEM '88 Digest, p263 Jun 88.

Keywords: Surface roughness, Scattering, Standards, Reprints, *Coaxial air lines.

Scattering parameter expressions are developed for the principal mode of a coaxial air line. Dimensional variations in the inner and outer conductors and skin effect are included in the model. An error analysis reveals accuracy of the scattering parameters is primarily dependent on the conductor radii measurements precision.

Resistive, Capacitive, & Inductive Components

800,646

PB88-175146

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.

Thin-Film Cryogenic Resistors from Aluminum Alloys.

Final rept.,

N. N. Tadoros, and L. B. Holdeman. 1985, 4p

Pub. in Cryogenics 25, n12 p709-712 Dec 85.

Keywords: *Film resistors, Electrical measurement, Aluminum alloys, Thin films, Cryogenics, Reprints.

The temperature dependence of the resistances of thin films sputtered from three commercially available aluminum alloys (5052, 5086, 5456) has been measured in the temperature range 1.5 K to 4.2 K. The 5052-alloy films had a positive temperature coefficient of resistance (TCR) throughout this temperature range, whereas films of the other two alloys had negative TCR's. A 250-nm-thick sample of 5052 alloy had a TCR of 3 ppm/K. The sample also had a relative resistance variation of 1 ppm after thermal cycling between 4.2 K and room temperature.

800,647

PB88-175732

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Short Range Transducer Applications of Ferroelectric Polymers.

Final rept.,

A. S. DeReggi, and P. A. Lewin. 1987, 28p

Pub. in Applications of Ferroelectric Polymers, Chapter 7, p162-189 1987.

Keywords: *Electroacoustic transducers, *Ferroelectric materials, *Polymers, Hydrophones, Biomedical measurement, Uses.

The chapter provides information on the recent developments in the applications of ferroelectric polymers, copolymers and blends as electroacoustic transducers. The general principles of transducer design, including the intrinsic noise properties of the transducing material, are summarized briefly, and selected examples of typical polymer transducer designs are reviewed. Both transmitting transducers and receiving transducers are included in the discussion. Emphasis is given to imaging transducers and hydrophone probes for biomedical applications. The possibility of constructing a polymeric probing hydrophone for measuring very short duration and very high pressure shock phenomena is demonstrated as a promising new application.

800,648

PB88-188529

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Equivalent Flux Noise in a YBa₂Cu₃O_x rf SQUID (Superconducting Quantum Interference Device).

Final rept.,

J. E. Zimmerman, J. A. Beall, M. W. Cromar, and R. H. Ono. 1987, 2p

Pub. in Japanese Jnl. of Applied Physics 26, p2125-2126 1987.

Keywords: Reprints, *High temperature superconductors, *SQUID devices, *Yttrium barium cuprates, *Barium copper yttrium oxides.

The authors have measured the noise in flux-locked rf SQUIDS made of bulk YBa₂Cu₃O_x both in a He cooled cryostat and in liquid nitrogen (LN₂). Their best results at 75 K show a spectral density of the equivalent flux noise equal to 0.00045(φi sub 0)/(Hz to the 1/2 power). There is considerable variation in the performance of SQUIDS made from nominally similar material.

800,649

PB88-252903

PC A03/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

NBS (National Bureau of Standards) Measurement Services: Calibration Service for Voltage Transformers and High-Voltage Capacitors.

Special pub. (Final),

W. E. Anderson. Jun 88, 39p NBS/SP-250/33

Also available from Supt. of Docs. as SN003-003-02880-1. Library of Congress catalog card no. 88-600542.

Keywords: *Calibrating, *Transformers, *Capacitors, *High voltage, Dissipation factor, Procedures, US NBS.

The National Bureau of Standards calibration service for voltage transformers and high-voltage capacitors is described. The service for voltage transformers supports the measurement of ratio correction factors and phase angles at primary voltages up to 170 kV and secondary voltages as low as 10 volts at 60 Hz. Calibrations at frequencies from 50-400 Hz are available over a more limited voltage range. The service for high-voltage capacitors supports the measurement of capacitances and dissipation factors at applied voltages ranging from 100 V to 170 kV at 60 Hz depending on the nominal capacitance. Calibrations over a reduced voltage range at other frequencies are also available. As in the case with voltage transformers, these voltage constraints are determined by the facilities at the National Bureau of Standards.

800,650

PB89-101398

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.

High Fidelity Piezoelectric Tangential Displacement Transducer for Acoustic Emission.

Final rept.,

T. M. Proctor. 1988, 7p

Pub. in Jnl. of Acoustic Emission 7, n1 p41-47 1988.

Keywords: *Tangent modulus, Displacement, Elastic properties, Modulus of elasticity, Reprints, *Piezoelectric transducers, *Acoustic emission.

A number of years ago the authors developed a high fidelity transducer for measuring the normal component of the dynamic displacement of the surface of an elastic body. Herein is described a companion transducer that measures the tangential component for the same configuration. The transducer has a relatively flat response over a 1.5 MHz bandwidth and a sensitivity of 0.3 to 0.5 mV/pm. Modal separation between the desired tangential mode and the unwanted normal mode is shown to be greater than 30 dB.

800,651

PB89-101521

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Coil Parameter Influence on Eddy Current Probe Sensitivity.

Final rept.,

T. E. Capobianco, and D. F. Vecchia. 1988, 6p

Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v7A p487-492 1988.

Keywords: *Nondestructive tests, *Electric coils, *Electrical fault location, Eddy currents, Design criteria, Performance evaluation, Sensitivity, Reprints.

Results of a study undertaken to quantify causes of sensitivity variations found in commercial eddy current probes are reported. Electrical parameter measurements made on a number of commercially produced coils indicate that coil reproducibility is not a major problem in the probe construction process. On the other hand, commercial probes designed for a particular inspection can have sensitivities differing by almost an order of magnitude. The study evaluates the effects on sensitivity of changes in the physical parameters of small ferrite core coils. Among the parameters studied were wire gauge, number of wire turns, coil aspect ratio, ferrite permeability, and operating frequency. The criteria used to gauge probe sensitivity are the impedance changes observed on applying the coils to four semi-elliptical electrical discharge machined (EDM) notches in aluminum and to aluminum and titanium test blocks. The results indicate that coils with similar electrical characteristics but different physical parameters can have significant differences in sensitivity.

800,652

PB89-126973

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.

Monitoring the U.S. Legal Unit of Resistance via the Quantum Hall Effect.

Final rept.,

M. E. Cage, R. F. Dziuba, B. F. Field, T. E. Kiess,

and C. T. Van Degrieff. 1987, 4p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p222-225 Jun 87.

Keywords: *Electrical resistance, *Standards, *Measurement, Hall effect, Resistance, Reprints.

The quantum Hall effect is being used to monitor the resistances of the five 1-Ohm Thomas-type resistors which define the U.S. legal unit of resistance, Ohm, NBS. Typically, the total 1 sigma accuracy for the transfer between three different GaAs quantum Hall devices and the five 1-Ohm resistors is + or - 0.05 ppm. Measurements to data provide the first direct evidence that the value of Ohm, NBS is decreasing by about (0.05 + or - 0.02) ppm/year.

Semiconductor Devices

800,653

PB88-174230

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Contact Resistance of Al-1%Si-0.5%Cu and Al/TiW/PtSi Metallization.

Final rept.,

L. Lie, D. Pramanik, A. N. Saxena, J. A. Mazer, and L. W. Linholm. 1985, 10p
 Pub. in Proceedings of the International Institute of Electrical and Electronics Engineers VLSI Multilevel Interconnection Conference (2nd), Santa Clara, CA, June 25-26, 1985, p201-210.

Keywords: *Integrated circuits, Electric contacts, Microelectronics, Metallizing, Silicon, Wafers, Semiconductor junctions, *Very large scale integration, *Contact resistance, Chips(Electronics), Aluminum alloy 0.5Cu 1Si.

The specific contact resistivity, $\rho(c)$, has been measured using six-terminal Kelvin contact resistor test structures with contacts of varying sizes. Values of $\rho(c)$, were determined for Al-1%Si-0.5%Cu metallizations to n(+) and p(+) silicon junctions having different surface concentrations, c(c). The magnitude of $\rho(c)$, was found to decrease with increasing c(c). Values of $\rho(c)$ were also determined for PtSi/TiW/Al contact metallizations to n(+) and p(+) and were found to be at least two times lower than that for Al-Si metallization. Also, the variation of $\rho(c)$, across the wafer for PtSi was found to be less than that for Al-Si. This indicates that PtSi/TiW/Al metallizations offer advantages when compared to Al-Si metallization and can contribute to improved performance of future VLSI circuits.

800,654

PB88-176789

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Hydrodynamic Carrier Transport in Semiconductors with Multiple Band Minima.

Final rept.,

C. L. Wilson. 1988, 8p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices 35, n2 p180-187 Feb 88.

Keywords: *Semiconductor devices, *Field effect transistors, *Carrier mobility, Gallium arsenides, Mathematical models, Simulation, Reprints, Two dimensional.

Carrier transport equations for analysis of semiconductor devices fabricated in materials with multiple band minima, such as GaAs, are presented. An alternate approach is taken in which the carrier density is conserved and an approximation to the distribution function in terms of quasi-Fermi potentials, carrier temperatures, and other fixed parameters is used that satisfies the particle energy and temperature distributions for each valley in the material. A model of a GaAs MESFET, which illustrates the importance of the new physical effects and achieves reasonable agreement with experiment without use of adjustable parameters, is presented as an example.

800,655

PB88-176805

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Effect of Sintering on the Sheet Resistance Directly Under an Aluminum/Silicon Ohmic Contact.

Final rept.,

J. A. Mazer, and J. R. Ehrstein. 1986, 1p

Pub. in Jnl. of the Electrochemical Society 133, n3 p109C 1986.

Keywords: *Integrated circuits, *Electric resistance, *Sintering, Electric contacts, Aluminum, Silicon, Reprints, *Ohmic contacts, Sheet resistance.

Van der Pauw-type measurements with a specially designed test structure, and spreading resistance measurements, indicate that the sheet resistance directly under a sintered 1% Si-Al/Si ohmic contact is lower than the sheet resistance of the diffused layer away from the contact. These results agree with transmission-line calculations made with measurements from six-terminal Kelvin test structures, and allow an improved calculation of the circuit-loading (or front contact) resistance.

800,656

PB88-176821

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Well-Defined Contacts Produce Accurate Spreading Resistance Measurements.

Final rept.,

G. P. Carver, S. S. Kang, J. R. Ehrstein, and D. B. Novotny. 1987, 5p

Pub. in Jnl. of the Electrochemical Society 134, n11 p2878-2882 Nov 87.

Keywords: *Silicon, *Electrical resistivity, Electric contacts, Reprints, *Spreading resistance.

Values of silicon resistivity calculated from spreading resistance measurements agree with values of resistivity determined from four-point measurements over a range of dopant density from 9×10 to the 14th power, to 2×10 to the 17th power/cc. The resistivity values from the spreading resistance measurements were determined solely using a mathematical expression based upon a simple geometrical model, without the need for a separate calibration. The measurements were made using aluminum-silicon contact, have a well-defined geometry. Arrays of such contacts were also used to examine local resistivity variations. Two-contact spreading resistance measurements are shown to underestimate the amplitude of resistivity variations compared to one-contact measurements.

800,657

PB88-184759

CP T05

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

XYZ: A Program for Semiconductor IC Thermal Analysis.

Software,

J. Albers, and C. Ellenwood. Apr 84, mag tape NBS/SW/MT-88/006

Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB88-184767.

Keywords: *Software, *Integrated circuits, *Semiconductor devices, Thermal analysis, L = Fortran, H = VAX-11/780.

A computer program, XYZ, for the thermal analysis of semiconductor integrated circuits is presented and its applications are discussed. The program makes use of the closed form, analytic solution of the steady-state heat flow problem for a rectangular three-layer structure with multiple heat sources on the top layer. The temperature may be obtained for any point or set of points in the structure and is useful in the determination of the steady-state thermal response of IC chips and packages...Software Description: The model is written in the FORTRAN programming language for implementation on a DEC VAX 11/785 Computer using the VMS 4.4 operating system.

800,658

PB88-184767

PC A04/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Semiconductor Measurement Technology: XYZ: A Program for Semiconductor IC Thermal Analysis.

Special pub. (Final),

J. Albers. Apr 84, 72p NBS/SP-400/76, NBS/SW/MT-88/006A

For system on magnetic tape, see PB88-184759. Also available from Supt. of Docs.

Keywords: *Semiconductor devices, *Integrated circuits, *Thermal analysis, Computer applications, Fourier analysis, Heat transmission, Steady state, Thermal resistance, Temperature distribution, XYZ computer program.

A computer program, XYZ, for the thermal analysis of semiconductor integrated circuits is presented and its applications are discussed. The program makes use of the closed form, analytic solution of the steady-state heat flow problem for a rectangular three-layer structure with multiple heat sources on the top layer. The temperature may be obtained for any point or set of points in the structure and is useful in the determination of the steady-state thermal response of IC chips and packages.

800,659

PB88-194352

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

NMOS Test Chip for Instruction in Semiconductor Parameter Measurements.

Final rept.,

K. P. Roenker, B. L. Harner, and L. W. Linholm. 1985, 6p

See also PB84-216506.

Pub. in Proceedings of Biennial University/Government/Industry Microelectronics Symposium (6th), Auburn, AL, June 11-13, 1985, p100-105.

Keywords: *Integrated circuits, Microelectronics, Test equipment, Chips(Electronics), NMOS, Metal oxide semiconductors.

The paper describes an NMOS test chip, NBS-40, designed for use in a graduate-level course in the measurement of semiconductor parameters using test structures. The rationale and objectives of a parameter measurements course are discussed, and the organization and results of a course offered at the University of Cincinnati are described. The test chip layout and test structures are briefly described, and parameter measurements using the test structures are discussed. An NBS technical report describing the test chip has been prepared and is available as a student reference. Examples of recent measurement results obtained on chips fabricated through the MOSIS service are provided to demonstrate the functionality of the chip.

800,660

PB88-194360

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Silicon Quality Versus Thickness for Novel Silicon on Boron Phosphide SOI (Silicon on Insulator) Process.

Final rept.,

P. J. Robertson, D. J. Dumin, G. P. Carver, D. B. Novotny, and M. Freytag. 1987, 6p

Pub. in Proceedings of Spring Meeting of the Materials Research Society, Anaheim, CA, April 21-25, 1987, p381-386.

Keywords: *Semiconducting films, Silicon, Capacitors, Transistors, Epitaxy, Wafers, Substrates, *SOI (Semiconductors), Boron phosphides, Metal oxide semiconductors.

Results are reported for a single temperature Si-BP-Si process which uses 0.2 and 0.4 micrometer of high resistivity BP covered by a single 1-5 micrometer silicon epitaxial layer on which PMOS devices were fabricated. Transistor and capacitor measurements were used to characterize the quality of the silicon films. MOS transistors manufactured on these layers did not work properly. Device characteristics improved on thicker silicon layers. Characteristics of devices fabricated on 5 micrometer silicon layers were comparable to those of devices fabricated on bulk silicon processed at the same time, indicating high quality silicon growth.

800,661

PB88-194378

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Measurements for Accurate MOS Transistor Simulation.

Final rept.,

P. Roitman, C. L. Wilson, J. L. Blue, and K. F. Galloway. 1985, 9p

Pub. in Proceedings of International Workshop on Physics of Semiconductor Devices (3rd), Madras, India, November 27-December 2, 1985, p69-77.

Keywords: *Metal oxide transistors, *Field effect transistors, Electrical measurement, Mathematical models, Simulation, Silicon, Phosphorus, *MOSFET, Carrier mobility.

Measurements and input data required for accurate numerical simulation of MOS transistor characteristics are described. Techniques for determining dopant atom distributions, geometric parameters, and carrier mobility in the channel are discussed. The results are used to simulate the electrical characteristics of self-aligned, silicon-gate, n-channel MOSFETs with phosphorus source-drains having channel lengths of 0.80 micrometer, 1.83 micrometers, and 8.17 micrometers. It is possible to model the drain current for all of the transistors studied without adjustable parameters. If sufficiently accurate parameters are available, the characteristics of submicron transistors can be predicted with plus or minus 5% accuracy.

800,662
PB88-194386 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Semiconductor Electronics Div.

Test Structures and Expert Systems for Process Control.

Final rept.,
 L. W. Linholm, D. J. Radack, C. P. Reeve, M. W. Cresswell, L. R. Lowry, and N. Pessall. 1987, 11p
 Pub. in Technical Proceedings, SEMICON/West, San Mateo, CA., May 19-21, 1987, p54-64.

Keywords: *Process control, *Integrated circuits, Artificial intelligence, Test equipment, Algorithms, Reprints, *Very large scale integration, Expert systems, Chips(Electronics), Computer aided manufacturing.

The paper describes the test structures, test results, data analysis algorithms, and a developmental expert system which can be used as a means of improving selected aspects of process control. A prototype expert system has been developed to allow rapid evaluation of selected portions of a 1-micrometer fabrication process. Test results from custom designed test chips containing a variety of structures comprise the input to the expert system. The output is an English-language process diagnosis. Examples of a diagnosis provided by the expert system for selected portions of a VLSI process are presented.

800,663
PB88-194394 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Semiconductor Electronics Div.

Limitations of Isotropic Theory of Band-Gap Narrowing in Si and GaAs Devices.

Final rept.,
 J. R. Lowney, and H. S. Bennett. 1987, 3p
 Pub. in Proceedings of Bipolar Circuits and Technology Meeting, Minneapolis, MN., September 21-22, 1987, p157-159.

Keywords: *Energy bands, Semiconductor doping, Gallium arsenides, Silicon, *Bipolar transistors, Doped materials.

The theory of band-gap narrowing, based on uniform material, is shown to be invalid for devices with very large doping gradients. Calculations also show that enhanced narrowing results from the built-in field.

800,664
PB88-194535 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Semiconductor Electronics Div.

Two-Dimensional Modeling of Channel Hot-Electron Effects in Silicon MOSFETs.

Final rept.,
 C. L. Wilson, and T. J. Russell. 1985, 4p
 Pub. in Proceedings of International Electron Devices Meeting - Technical Digest, Washington, DC., December 1-4, 1985, p72-75.

Keywords: *Metal oxide transistors, *Field effect transistors, *Silicon, *Mathematical models, Silicon dioxide, Interfaces, *MOSFET, Two-dimensional calculations, Hot electrons.

Earlier models have successfully modeled currents associated with device degradation due to channel hot-electrons. In the work, a high accuracy two-dimensional model of a silicon MOSFET is combined with a model of the SiO₂-Si interface which includes both the energy dependence of the interface traps within the silicon bandgap and the positional dependence of the oxide charge and the interface traps along the channel of the transistor. The model allows the effects of channel hot-electrons on the subthreshold, linear, and saturation region after injection of the device to be modeled without introducing free parameters.

800,665
PB88-194543 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Semiconductor Electronics Div.

Using Silicon Device Modeling Techniques for GaAs Devices.

Final rept.,
 C. L. Wilson. 1985, 4p
 Pub. in Proceedings of International Electron Devices Meeting - Technical Digest, Washington, DC., December 1-4, 1985, p78-81.

Keywords: *Field effect transistors, *Gallium arsenides, *Mathematical models, Computerized simulation,

Partial differential equations, Monte Carlo method, Two-dimensional calculations.

Numerical models have been developed for Si MOS-FETs which achieve high accuracy and retain numerical stability and physical flexibility. The methods used in these models can be applied to GaAs MESFETs to yield a computer model which retains the accuracy and robust numerical properties of two-dimensional Si MOSFET models, yet retains most of the physical detail of Monte Carlo simulation. Two significant differences between this model and previous models result. First, by incorporating intraband scattering directly, high field regions of the device are seen to be dominated by alternate regions in which conduction by central valley and satellite valley electrons dominate. Second, the two-dimensional field shape in the part of the transistor between the gate and the drain is critical in calculating the intraband scattering and in determining the average effective mobility.

800,666
PB88-198015 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Semiconductor Electronics Div.

Specific Contact Resistivity of Metal-Semiconductor Contacts - A New, Accurate Method Linked to Spreading Resistance.

Final rept.,
 G. P. Carver, J. J. Kopanski, D. B. Novotny, and R. A. Forman. 1988, 9p
 Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices 35, n4 p489-497 Apr 88.

Keywords: *Electric contacts, Integrated circuits, Electrical resistivity, Silicon, Metals, Reprints, *Contact resistance, Schottky diodes, Spreading resistance.

A new method to determine the specific contact resistivity of metal-semiconductor contacts has been developed. It allows the separation of the total series resistance between two contacts into the contributing component resistances. The principle of the method is the subtraction of the semiconductor spreading resistance from the total two-contact resistance. This requires geometrically well-defined small contacts that are fabricated precisely by lithographic methods. Using this method, accurate values were obtained for the specific contact resistivity of an aluminum-1.5-percent silicon alloy to p-type silicon wafers. The specific contact resistivity values are lower than previously published values obtained using earlier methods in which parasitic and nonideal effects could not be quantified or eliminated. The lower values indicate that contact resistance has a less limiting effect on the performance of integrated circuits than presently believed.

800,667
PB88-198023 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Semiconductor Electronics Div.

Acoustic Emission Thermal Shock Test for Hybrid Microcircuit Packages.

Final rept.,
 G. G. Harman. 1987, 5p
 Pub. in Nondestructive Testing Handbook, pt5 p365-369 1987.

Keywords: *Glass to metal seals, Hermetic seals, Thermal shock, Microelectronics, Tests, *Acoustic emission testing, *Hybrid circuits.

An acoustic-emission-monitored test for hybrid microcircuit package integrity was developed. It consists of a hot stage operating at 400 C, a special water-cooled acoustic-emission detector mount, and appropriate signal recording equipment. In use, the detector is coupled to the back of a hybrid package and both are set on the hot stage for approximately 30 s. Any acoustic-emission signals indicate thermal excursion damage to the glass-metal seals. The acoustic-emission signals were correlated with both room temperature and 125 C leak tests of the packages.

800,668
PB88-198031 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Semiconductor Electronics Div.

Acoustic Emission Test for Microelectronic Tape Automated Bonding.

Final rept.,
 G. G. Harman. 1987, 4p
 Pub. in Nondestructive Testing Handbook, pt4 p361-364 1987.

Keywords: *Semiconductor devices, Electric contacts, Microelectronics, Bonding, *Acoustic emission testing.

An acoustic-emission (AE) test method for tape automated bonding (TAB) integrity has been developed. It consists of a precision testing machine that simultaneously applies a clamping force on the semiconductor chip and a lifting force on the electrical interconnecting leads. Acoustic-emission signals are transmitted through a waveguide to the detector. The system also permanently forms (raises) the leads, which is a normal requirement for TAB devices. Large acoustic-emission signals occur when a lead breaks, a bump lifts, or a weld crack propagates. Appropriate AE signal processing is also discussed.

800,669
PB88-199054 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Semiconductor Electronics Div.

Electromigration Guidelines for (t sub 50) Measurements.

Final rept.,
 H. A. Schafft. 1986, 13p
 Pub. in Proceedings of Wafer Reliability Assessment Workshop, Lake Tahoe, CA., October 19-22, 1986, p149-161.

Keywords: Electrical measurement, Instructions, *Electromigration.

No abstract available.

800,670
PB88-200340 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Semiconductor Electronics Div.

Developmental Expert System for Test Structure Data Evaluation.

Final rept.,
 L. W. Linholm, D. Khera, C. P. Reeve, and M. W. Cresswell. 1988, 4p
 Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Conference on Microelectronic Test Structures, Long Beach, CA., February 22-23, 1988, p160-163.

Keywords: *Integrated circuits, *Lithography, Line width, Microelectronics, Tests, Test sets, *Expert systems, Chips(Electronics).

The paper describes a developmental expert system, rule generation techniques, a test chip, data handling methods, and statistical data reduction techniques for characterizing the performance of a 1-micrometer lithography process. Examples of test results and an expert system diagnosis are given.

800,671
PB88-200357 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Semiconductor Electronics Div.

Microelectronic Test Structure for Thickness Determination of Homogeneous Conducting Thin Films in VLSI (Very Large-Scale Intergration) Processing.

Final rept.,
 J. S. Kim, L. W. Linholm, B. L. Barley, M. H. Hanes, and M. W. Cresswell. 1988, 5p
 Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Conference on Microelectronic Test Structures, Long Beach, CA., February 22-23, 1988, p34-38.

Keywords: *Integrated circuits, *Dimensional measurement, Electrical resistivity, Line width, Test sets, *Very large scale integration, *Film thickness.

The paper describes a new test structure for use in determining the thickness of a uniform conducting film. The structure incorporates the van der Pauw cross method to determine the effective sheet resistance of a vertical, uniformly doped cross section of a polysilicon film and a bridge resistor to determine thickness of the film. By using a composite structure, which consists of the vertical cross structure and a conventional planar cross-bridge test structure, it is possible to obtain the thickness, linewidth, and resistivity of a conducting line.

800,672
PB88-200365 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Semiconductor Electronics Div.

ELECTROTECHNOLOGY

Semiconductor Devices

Thermal Interactions between Electromigration Test Structures.

Final rept.,

H. A. Schafft, and J. Albers. 1988, 6p
Grant ARPA Order-3882

Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Conference on Microelectronic Test Structures, Long Beach, CA., February 22-23, 1988, p132-137.

Keywords: *Integrated circuits, Microelectronics, Reliability(Electronics), Temperature measurement, Thermal resistance, Interactions, Tests, Test sets, *Electromigration.

The thermal interaction between electromigration test structures on a test chip, when subjected to a high current-density stress, must be considered when making median-time-to-failure measurements.

800,673

PB88-200373

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Test Circuit Structures for Characterizing the Effects of Localized Hot-Carrier-Induced Charge in VLSI (Very Large-Scale Integration) Switching Circuits.

Final rept.,

J. S. Suehle, and K. F. Galloway. 1988, 6p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) International Conference on Microelectronic Test Structures, Long Beach, CA., February 22-23, 1988, p126-131.

Keywords: *Switching circuits, *Integrated circuits, Test sets, *Very large scale integration, Hot carriers, MOSFET.

Data are presented that were collected from test circuit structures that were hot-carrier-stressed under conditions existing in actual VLSI switching circuits. It is shown that the localized nature of hot-carrier-induced damage to n-channel MOSFETs must be considered to accurately model these data by computer circuit simulations.

800,674

PB88-204870

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Designing Microelectronic Welds for Acoustic Emission Testability.

Final rept.,

G. G. Harman. 1987, 2p

Pub. in Nondestructive Testing Handbook, p409-410 1987.

Keywords: *Microelectronics, *Welded joints, *Nondestructive tests, Design, *Acoustic emissions.

No abstract available.

800,675

PB88-227772

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.

ASTM (American Society for Testing and Materials) and SEMI Standards for the Semiconductor Industry.

Final rept.,

R. I. Scace. 1987, 4p

See also PB87-122404.

Pub. in Emerging Semiconductor Technology, ASTM Special Technical Publication 960, p15-18 1987.

Keywords: *Standards, Semiconductor devices, *Semiconductor industry, International cooperation.

The article, based on an introductory talk at the symposium, points out the needs for standards in the semiconductor industry and briefly describes the activities of the organizations that develop them. The direct cooperation between the several organizations in the world active in semiconductor standards development is briefly described. Readers are invited to join these development activities.

800,676

PB88-228309

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

CMOS Process Monitor.

Final rept.,

M. G. Buehler, L. W. Linholm, V. C. Tyree, R. A. Allen, B. R. Blaes, G. A. Jennings, and K. A. Hicks. 1988, 5p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Proceedings on Microelectronic Test Structures 1, n1 p164-168 Feb 88.

Keywords: *Integrated circuits, Microelectronics, Wafers, Process control, Monitors, *Very large scale integration, Chips(Electronics), CMOS.

A CMOS Process Monitor, consisting of eight basic test structures, has been prepared to acquire key CMOS parameters to assist in VLSI wafer acceptance. The test structures can be probed using a 2 by N probe pad array and can be arranged to fit into either the interior or the scribe lane of an integrated circuit chip. In order to facilitate the general use of the monitor, a document is being prepared that describes its design, layout, measurement, and analysis. The paper describes the structures included in the monitor, the methodology used to create the monitor, and test results from the monitor.

800,677

PB88-228341

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Steady-State Model for the Insulated Gate Bipolar Transistor.

Final rept.,

A. R. Hefner, D. L. Blackburn, and K. F. Galloway. 1987, 17p

Pub. in Proceedings of International Workshop Physics of Semiconductor Devices (4th), Madras, India, December 10-15, 1987, p22-38.

Keywords: Steady state, Models, *Bipolar transistors, MOSFET.

The power Insulated Gate Bipolar Transistor (IGBT) is a switching device designed to overcome the high on-state loss of the power MOSFET. The IGBT behaves as a bipolar transistor which is supplied base current by a MOSFET. The bipolar transistor of the IGBT has a wide base with the base contact at the collector edge of the base and is operated with its base in high-level injection. The usual bipolar transistor models are not adequate for the IGBT. The paper describes a model for the IGBT developed using ambipolar transport.

800,678

PB88-228358

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Statistics for Electromigration Testing.

Final rept.,

H. A. Schafft, J. A. Lechner, B. Sabi, M. Mahaney, and R. C. Smith. 1988, 11p

Pub. in Proceedings of Annual Reliability Physics Conference (26th), Monterey, CA., April 12-14, 1988, p192-202.

Keywords: *Integrated circuits, Accelerated tests, Reliability(Electronics), Normal density functions, Metallizing, Statistical analysis, *Electromigration.

A comprehensive statistical basis is given for the design and conduct of electromigration stress tests that allows for the efficient use of test parts, equipment, and test time. It shows how to select the size of the sample, the required control of the stress conditions, and the number of failures required before halting the test in order to characterize metallization interconnects with a quantifiable level of confidence. The results are applicable to any failure mechanism for which the failure times obey a Normal or a log-Normal distribution.

800,679

PB89-127195

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.

Influence of Electrical Fields on Diffusion of Donors and Acceptors in Semiconductor Junctions.

Final rept.,

P. H. E. Meijer, M. Keskin, and M. Napiorkowski. 1988, 6p

Pub. in Jnl. of Applied Physics 63, n5 p1608-1613, 1 Mar 88.

Keywords: *Diffusion, *Semiconductor junctions, *Electric fields, Semiconductor devices, Electric potential, Quantum statistics, Reprints.

Diffusion in semiconductor junctions (hetero, homo, and graded) is influenced by the fields present in the junction. The potential, present in the junction is determined by the Poisson equation, in which the charge density depends on the internal potential. This potential is determined by Fermi-Dirac statistics applied to the valence band, the conduction band, and the impurity levels in, and near, the junction. The authors utilize the complete set of equations, rather than the standard simplified model based on the use of impurity levels only. Solution of the problem is accomplished in two ways: first, a number of possible approximations are evaluated and discussed; second, the equations are solved numerically and the results are compared with the previously made approximations. Special attention is paid to the case of a graded junction.

General

800,680

PB88-168703

PC A03/MF A01

National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.

NBS (National Bureau of Standards) Measurement Services: Solid-State DC Voltage Standard Calibrations.

Special pub. (Final),

B. F. Field. Jan 88, 43p NBS/SP-250/28

Also available from Supt. of Docs. as SN003-003-02842-8. Library of Congress catalog card no. 87-619904.

Keywords: *Standards, Direct current, Avalanche diodes, *Voltage standards, *Calibration, US NBS.

The document describes the procedures used at NBS to calibrate solid-state dc voltage standards in terms of the U.S. Legal Volt. The process involves calibrating client standards at NBS approximately 10 times over a two week period. The operational procedures and apparatus used to compare the client standards to the U.S. Legal Volt are discussed in detail.

800,681

PB88-169768

(Order as PB88-169727, PC A05)

National Bureau of Standards (NEL), Gaithersburg, MD.

Phase Meter Calibration at NBS (National Bureau of Standards).

R. S. Turgel. 1988, 8p

Included in Jnl. of Research of the National Bureau of Standards, v93 n1 p53-60 Jan-Feb 88.

Keywords: *Phase meters, *Standards, Phase angle, Alternating current, Signal generators, *Calibration, Calibration standards, US NBS, Uncertainty.

To provide a phase meter calibration service, a phase angle calibration standard has been developed at NBS. This standard is a signal generator with two sinusoidal outputs and uses direct digital synthesis to generate the signals. The phase angle between the two sinusoids is determined by the input parameters in the calculation of the sets of digital values from which the analog output is synthesized. An auto-zero compensation mode corrects the residual phase differences in the two output channels. The phase resolution is better than 0.002 deg. over a frequency range from 2 Hz to 5 kHz and 0.005 deg. from 5 to 50 kHz. Phase meter calibration data are fitted to a linear model from which appropriate corrections for the phase meter readings can be derived. Statistical treatment of the data provides an estimate of the uncertainty of the corrected phase meter readings relative to the phase angle calibration standard.

800,682

PB88-169990

PC A03/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.

Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, April to June 1987, with 1988

IEEE Events Calendar,

E. J. Walters. Dec 87, 24p NBSIR-87/3697

See also PB88-130323.

Keywords: *Electronics, *Electrical engineering, Semiconductor devices, Metrology, Signal processing, Bibliographies, Electromagnetic interference.

This is the thirteenth issue of a quarterly publication providing information on technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue contains reports on: Semiconductor technology; Fast signal acquisition, processing, & transmission; Electrical systems; Electromagnetic interference and additional information including the 1988 CEEE calendar.

800,683
PB88-176466 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
New Approach to Volumes Irradiated by Unknown Sources.

Final rept.,
J. Randa, and M. Kanda. 1987, 9p
Pub. in IEEE (Institute of Electrical and Electronic Engineers) Transactions on Electromagnetic Compatibility EMC-29, n4 p273-281 Nov 87.

Keywords: *Electromagnetic fields, Maxwells equations, Reprints, Successive overrelaxation method, Ill posed problems, Numerical solution.

The authors suggest an approach to the characterization of electromagnetic (EM) environments irradiated by unknown sources. The approach is based on the numerical solution of Maxwell's equations subject to the constraints imposed by the measured values of the field at a small number of measurement points and by boundary conditions. A thorough examination of a method for the numerical solution is presented. The examples attempted to demonstrate the approach but reveal deficiencies in the numerical method. Possible future directions are suggested.

800,684
PB88-176482 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Technology Div.
Josephson Array Voltage Standard at 10 V.
Final rept.,
F. L. Lloyd, C. A. Hamilton, J. A. Beall, D. Go, R. H. Ono, and E. Harris. 1987, 2p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Electron Device Letters EDL-8, n10 p449-450 Oct 87.

Keywords: *Standards, *Josephson junctions, Reprints, *Voltage standards, Josephson effect.

The technology of Josephson voltage standards has been extended to an array of 14,184 junctions which is capable of generating over 150,000 quantized voltage levels spanning the range from -12 to +12 V. This makes possible the direct calibration of 10-V Zener reference standards without the use of a voltage divider.

800,685
PB88-176490 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Technology Div.
Precision of Series-Array Josephson Voltage Standards.
Final rept.,
R. L. Kautz, and F. L. Lloyd. 1987, 3p
Pub. in Applied Physics Letters 51, n24 p2043-2045, 14 Dec 87.

Keywords: *Standards, *Josephson junctions, Precision, Comparison, Reprints, *Voltage standards, Josephson effect.

Comparison of two series-array Josephson voltage standards operated at over 1 V shows that they differ in voltage by less than 2 parts in 10 to the 17th power.

800,686
PB88-183991 PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, July to September 1987, with 1988 CEEE Events Calendar,
E. J. Walters. Feb 88, 38p NBSIR-88/3713
See also PB88-130315.

Keywords: *Electronics, *Electrical engineering, Metrology, Signal processing, Bibliographies, Superconductors.

This is the twentieth issue of a quarterly publication providing information on the technical work of the Na-

tional Bureau of Standards Center for Electronics and Electrical Engineering. The issue of the CEEE Technical Progress Bulletin covers the third quarter of calendar year 1987. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

800,687
PB88-187653 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Multijunction Thermal Converters as the NBS (National Bureau of Standards) Primary AC-DC Transfer Standards for AC Current and Voltage Measurements.
Final rept.,
F. L. Hermach, J. R. Kinard, and J. R. Hastings. 1986, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Gaithersburg, MD., June 23-27, 1986, p216-217.

Keywords: *Electrical measurement, *Standards, Electric current, Converters, Alternating current, Direct current, Transfer standards, Voltage.

A set of multijunction thermal converters (MJTCs) have been established as the NBS primary ac-dc transfer standards for ac current and voltage measurements. The choice is based upon the advantages of the MJTCs, the development of an improved emf comparator, an extensive series of intercomparisons, and numerous supporting investigations.

800,688
PB88-188511 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Time and Frequency Div.
Measurements of Frequency Stability.
Final rept.,
F. L. Walls, and D. W. Allan. 1986, 7p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) 74, n1 p162-168 Jan 86.

Keywords: *Frequency stability, Electrical measurement, Reprints, Frequency domain, Time domain.

The characterization of frequency stability in the time-domain and frequency-domain are briefly defined, and their relationships are explained. Techniques for making precise measurements of frequency fluctuations in oscillators, multipliers, dividers, amplifiers, and other components are discussed. Particular attention is given to methods of calibration which permit accuracies of 1 dB or better to be achieved when measuring in the frequency-domain. Common pitfalls to avoid are also covered, and efficient time-domain techniques are explained.

800,689
PB88-189261 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
In Honor of Professor Robert H. Cole's Seventieth Birthday.
Final rept.,
F. I. Mopsik, and J. D. Hoffman. 1985, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electrical Insulation EI-20, n6 p899-904 1985.

Keywords: *Electrical insulation, *Dielectrics, Biographies, Reprints, *Cole Robert H.

The authors present a short biography of Professor Robert H. Cole in honor of his seventieth birthday. They review his career as a scientist and teacher, and present his major accomplishments in the study of dielectric phenomena in matter. He has made major contributions to the study of solids, liquids, and gases both as dielectrics and as their molecular behavior. He made many experimental innovations as well as adding to theoretical understanding. A chronological bibliography of his work is included.

800,690
PB88-189337 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Methodology for Standard Electromagnetic Field Measurements.
Final rept.,
N. S. Nahman, M. Kanda, E. B. Larsen, and M. L. Crawford. 1985, 15p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-34, n4 p490-503 Dec 85.

Keywords: *Electromagnetic fields, *Standards, Electrical measurement, Anechoic chambers, Antennas, Field strength, Reprints.

Establishing standards for electromagnetic (EM) field measurements is a multifaceted endeavor which requires measurements made (1) in anechoic chambers, (2) at open-sites, and (3) within guided wave structures, and the means to transfer these measurements from one situation to another. The underlying principles of these standard measurements and transfer standards fall into one of the two categories: (1) measurements, and (2) theoretical modeling. The three measurement topics and field transfer standards mentioned above and discussed, with the guided wave structures being restricted to the TEM cell. The frequencies considered here range from 10 kHz to 18 GHz (and upward) and are dependent upon the physical constraints imposed by our ability to implement an actual measurement, subject to the conditions imposed by rigorous electrodynamic theory in a given analytical model.

800,691
PB88-189659 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Isotropic Electric-Field Probe with Tapered Resistive Dipoles for Broad-Band Use, 100 kHz to 18 GHz.
Final rept.,
M. Kanda, and L. D. Driver. 1987, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques MTT-35, n2 p124-130 Feb 87.

Keywords: *Electromagnetic fields, *Electric fields, Electrical measurement, Dipole antennas, Broadband, Low frequencies, Medium frequencies, High frequencies, Very high frequencies, Ultrahigh frequencies, Superhigh frequencies, Reprints, *Probes(Electromagnetic).

A new broad-band electric-field probe, capable of accurately characterizing and quantifying electromagnetic fields, has been developed at the National Bureau of Standards. The probe's 8-mm resistively tapered dipole elements allow measurement of electric fields between 1 and 1600 V/m from 1 MHz to 15 GHz, with a flatness of plus or minus 2 dB. A mutually orthogonal dipole configuration provides an overall standard deviation in isotropic response, with respect to angle, that is within plus or minus 0.3 dB. Both the theoretical and experimental aspects of this prototype electric-field probe are discussed in the paper.

800,692
PB88-193321 PC A03/MF A01
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Possible Design for Electric-Field-Strength Probes for Millimeter Waves,
J. Randa, M. Kanda, and D. Melquist. Feb 88, 40p
NBSIR-88/3084
Sponsored by Naval Ocean Systems Center, San Diego, CA.

Keywords: *Probes, *Electric fields, Design criteria, Field strength, Millimeter waves, Dipole antennas, Temperature measuring instruments, *Electric field strength.

Various designs are considered for electric-field probes for the frequency range 26-110 GHz. Two particular designs are investigated in some detail. A resistively tapered dipole antenna with a diode detector shows promise for frequencies up to about 40 GHz. The second design is based on a fiber-optically sensed temperature sensor to detect the heating of a resistive strip. Its sensitivity can be increased significantly, this design may be capable of operating to frequencies above 100 GHz.

800,693
PB88-193719 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.
Excitation and Ionization Coefficients.
Final rept.,
A. V. Phelps. 1987, 9p
Sponsored by Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH.

ELECTROTECHNOLOGY

General

Pub. in Proceedings of International Symposium on Gaseous Dielectrics (5th), Knoxville, TN., May 3-7, 1987, p1-9.

Keywords: *Gas ionization, *Dielectrics, Excitation, Nitrogen, Oxygen, Air, Sulfur hexafluoride, Cross sections.

The present status of theoretical calculations of excitation and ionization coefficients for electrons in some of the simpler molecular gases and their mixtures used as dielectrics are reviewed. Illustrative comparisons with experiment are made. Detailed discussions of cross section data and results of Boltzman calculations are presented for N₂, O₂, dry air, moist air and SF₆. References to other gases are cited.

800,694

PB88-193925

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

High-Frequency Errors of an Electric-Field Meter in Complicated Environments.

Final rept.,

J. Randa, and K. Kanda. 1985, 4p

Sponsored by Institute of Electrical and Electronics Engineers, Inc., Washington, DC.

Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Electromagnetic Compatibility, Wakefield, MA., August 20-22, 1985, p618-621.

Keywords: *Electric fields, Electric measuring instruments, Electrical measurement, High frequencies, Errors.

Results are reported of a study of electric-field-meter (EFM) errors in complex electromagnetic environments. Two types of errors are considered—errors in the measured electric field for a common EFM design, and errors in the assumption of equal electric and magnetic energy densities in a multiple-plane-wave environment. Typical errors in both cases are approximately one-half to three dB, but in some circumstances they can exceed 10 dB.

800,695

PB88-193933

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Concepts for ATE Systems Calibration: Transport Standards to Achieve Traceability to National Standards.

Final rept.,

T. F. Leedy, and B. A. Bell. 1988, 7p

Sponsored by Naval Weapons Center Corona Annex, CA.

Pub. in Proceedings of Measurement Science Conference, Long Beach, CA., January 28-29, 1988, p307-313.

Keywords: *Standards, Electrical measurement, Low frequencies, *Transport standards, *Automatic test equipment, Calibration, US NBS, Intercomparison.

Technical objectives are presented for a proposed transport standard to establish direct traceability of selected low-frequency electrical quantities between the National Bureau of Standards (NBS) and automatic test systems including the calibration laboratories that support these automatic test systems. The transport standard would consist of precision ac and dc voltage and frequency sources and could also include more specialized measurement modules in future versions. The transport standard would allow the intercomparison of dc voltage, ac (rms) voltage, total harmonic distortion, phase, and frequency measurements made using ATE systems.

800,696

PB88-194956

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Broadband, Electric-Field Probe Using Resistively Tapered Dipoles, 100 kHz - 18 GHz.

Final rept.,

M. Kanda, and L. D. Driver. 1986, 4p

Pub. in Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) MTT-S International Microwave Symposium Digest, Baltimore, MD., June 2-4, 1986, p621-624.

Keywords: *Electric fields, Electromagnetic fields, Dipole antennas, Broadband, Design, Performance, Medium frequencies, High frequencies, Very high frequencies, Ultrahigh frequencies, Superhigh frequencies, *Probes(Electromagnetic), Calibration.

The paper discusses the theoretical, design, fabrication, evaluation, and calibration aspects of a prototype broadband electric-field probe. Its resistively tapered miniature dipole elements allow measurement of electric fields between 1 and 1600 V/m from 1 MHz to 15 GHz, with a flatness of + or - 2 dB and an isotropic response of + or - 0.3 dB.

800,697

PB88-196530

PC A03/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.

Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, July to September 1987,

E. J. Walters. Apr 88, 27p NBSIR-88/3748

See also PB88-183991.

Keywords: *Electrical engineering, *Electronics, Antennas, Electrical engineering, Instrumentation, Lasers, Magnetics, Microwaves, Optical fibers, Semiconductors, Superconductors.

This is the fourteenth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. The issue of the Center for Electronics and Electrical Engineering Technical Publication Announcements covers the third quarter of calendar year 1987. Abstracts are provided by technical area for papers published this quarter.

800,698

PB88-204888

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Circular Array for Plane-Wave Synthesis.

Final rept.,

D. A. Hill. 1988, 6p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility 30, n1 p3-8 Feb 88.

Keywords: *Plane waves, Fourier series, Arrays, Synthesis, Reprints, Matrix inversion.

A circular array of electric line sources was analyzed for generating a uniform plane wave in the interior region of the array. Identical results for the synthesized element weightings are obtained using matrix inversion or a Fourier series technique. A physical optics approximation for the element weightings is also presented, but it yields a much poorer result for the synthesized field. The angle of arrival of the plane wave can be scanned by recalculating the element weightings, and the quality of the field is maintained. Frequency scanning is also possible, but the number of array elements limits the maximum frequency.

800,699

PB88-211149

PC A04/MF A01

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Electromagnetic Fields Radiated from Electrostatic Discharges: Theory and Experiment.

Technical note (Final),

P. F. Wilson, A. R. Ondrejka, M. T. Ma, and J. M. Ladbury. Feb 88, 73p NBS/TN-1314

Also available from Supt. of Docs. as SN003-003-02864-9

Keywords: *Electric discharges, *Electromagnetic fields, Electric fields, Magnetic fields, Mathematical models, *Electrostatic discharges, Electric dipoles, Time domain.

The fields radiated by electrostatic discharges (ESD) are studied both theoretically and experimentally. The ESD spark is modeled theoretically as an electrically short, time dependent, linear dipole situated above an infinite ground plane. Experimentally, sparks of varying voltages are generated by a commercially available simulator and used to excite a number of targets including (1) the extended inner conductor of a coaxial cable mounted in a ground plane, (2) direct discharges to a ground plane, (3) indirect radiation from a large metal plate, (4) a metal chair over a ground plane, and (5) a metal trash can. Results show that relatively low-voltage sparks (2-4 kV) excite the strongest radiated fields. This suggests that the spark fields can pose a significant interference threat to electronic equipment into the gigahertz range.

800,700

PB88-217922

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Isotropic Electric-Field Probe with Tapered Resistive Dipoles for Broadband Use, 100 kHz - 18 GHz.

Final rept.,

M. Kanda, and L. Driver. 1986, 6p

See also PB88-189659.

Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Electromagnetic Compatibility, San Diego, CA., September 16-18, 1986, p256-261.

Keywords: *Electromagnetic fields, *Electric fields, Electrical measurement, Dipole antennas, Broadband, Low frequencies, Medium frequencies, High frequencies, Very high frequencies, Superhigh frequencies, Ultrahigh frequencies, *Probes(Electromagnetic).

A new broadband electric-field probe, capable of accurately characterizing and quantifying electromagnetic (EM) fields, has been developed at the National Bureau of Standards (NBS). The probe's 8-mm resistively tapered dipole elements allow measurement of electric fields between 1 and 1,600 V/m from 1 MHz to 15 GHz, with a flatness of plus or minus dB. A mutually orthogonal dipole configuration provides an overall standard deviation in isotropic response, with respect to angle, that is within plus or minus 0.3 dB. Both the theoretical and developmental aspects of this prototype electric-field probe are discussed in the paper.

800,701

PB88-225636

PC A06/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

NBS (National Bureau of Standards) Measurement Services: NBS Phase Angle Calibration Services.

Special pub. (Final),

R. S. Turgel, J. M. Mulrow, and D. F. Vecchia. May

88, 117p NBS/SP-250/26

Also available from Supt. of Docs as SN003-003-02871-1. Library of Congress catalog card no. 88-600501. Prepared in cooperation with National Bureau of Standards (NEL), Boulder, CO. Statistical Engineering Div.

Keywords: *Phase meters, *Phase angle, Computer programs, Standards, Basic programming language, *Calibration, US NBS.

The National Bureau of Standards (NBS) offers a calibration service for audio-frequency phase meters. The calibrations are based on a phase angle standard developed at NBS that generates two sinusoidal signals, over a frequency range of 2 hertz to 50 kilohertz, displaced relative to one another by a precisely known phase angle. The signal amplitudes are independently adjustable on each channel from 0.5 volts to 100 volts. The angular resolution is better than 0.002 deg at the low end of the frequency range and decreases to 0.005 deg at the high end. The uncertainty of the phase angle between the two signals generated by the standard varies from 0.005 deg to 0.04 deg depending on frequency and amplitude. Using the phase angle standard, phase meter readings are obtained at selected test points. From the calibration data, the phase meter response characteristic is determined and is compared to that of an ideal meter having a linear characteristic. If the phase meter response conforms to the linear model, a straight-line calibration curve is derived from the data and serves to calculate corrected readings. From the statistical parameters associated with the calibration curve, it is possible to estimate the limits of offset between the calibrated meter and the calibration standard. By extension, the uncertainty of readings of the phase meter in the user's laboratory can be estimated.

800,702

PB88-228127

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

NBS (National Bureau of Standards) Initiatives in TMDE/ATE (Test, Measurement, and Diagnostic Equipment/Automatic Test Equipment) Diagnostics.

Final rept.,

O. Petersons. 1988, 5p

Pub. in Proceedings of National Security Industrial Association Diagnostics/Prognosis Symposium, Alexandria, VA., October 20-21, 1988, p191-195.

Keywords: Electromagnetic interference, Measurement, *Automatic test equipment, Calibration, US NBS.

NBS programs relevant to test, measurement, and diagnostic equipment (TMDE) and automatic test equipment (ATE) diagnostics are divided into two areas. The first area involves basic measurement tools and methods (data converter characterization, digital synthesis of signals, sampling techniques, and pulse standards). The second area involves applications (waveform recorder characterization, ATE verification, test procedures for bid samples, calibration testing strategies) to TMDE, ATE, and complex systems in general.

800,703
PB88-228135 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

New Method for Measuring the Stochastic Properties of Corona and Partial Discharge Pulses.

Final rept.,
R. J. Van Brunt, and S. V. Kulkarni. 1988, 5p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Electrical Insulation, Cambridge, MA., June 5-8, 1988, p233-237.

Keywords: *Electric corona, *Electric discharges, Stochastic processes, Probability distribution functions, Electrical measurement, Trichel pulses.

A new computer based method for measuring the stochastic properties of corona and partial discharge pulses is described. The method allows direct measurement of a set of conditional probability distributions that reveal correlations among successive pulse amplitudes, pulse time separations, and between pulse amplitudes and time separations. Application of the method to an investigation of ultra-violet sustained negative-corona (Trichel) pulses in air has shown the existence of strong correlations between pulse amplitudes and subsequent pulse time intervals as well as between amplitudes of successive pulses. The observed correlations are consistent with existing models for Trichel-pulse formation.

800,704
PB88-232913 PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, October to December 1987 with 1988 CEE Events Calendar.
E. J. Walters. Jun 88, 41p NBSIR-88/3762
See also PB88-183991.

Keywords: *Electronics, *Electrical engineering, Metrology, Signal processing, Bibliographies, Superconductors.

The report is the twenty-first issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. The issue of the CEE Technical Progress Bulletin covers the fourth quarter of calendar year 1987. The issue contains abstracts for all Center papers released for publication by NBS in the quarter and citations and abstracts for Center papers published in the quarter. Entries are arranged by technical topic as identified in the table of contents and alphabetically by first author under each subheading within each topic. Unpublished papers appear under the subheading 'Released for Publication'. Papers published in the quarter appear under the subheading 'Recently Published'. Following each abstract is the name and telephone number of the individual to contact for more information on the topic (usually the first author). The issue also includes a calendar of Center conferences and workshops planned for calendar year 1988 and a list of sponsors of the work.

800,705
PB88-238746 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Comparison between Near-Field Shielding-Effectiveness Measurements Based on Coaxial Dipoles and on Electrically Small Apertures.
Final rept.,
P. F. Wilson. 1988, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility 30, n1 p23-28 Feb 88.

Keywords: *Electromagnetic shielding, Effectiveness, Comparison, Electrical measurement, Magnetic dipoles, Apertures, Reprints, Electric dipoles, Near field.

The near-field shielding effectiveness (SE) of a material may be measured by placing it between two closely spaced dipoles (electric or magnetic) and noting the resulting insertion loss. An alternative approach is to cover an electrically small aperture with the test material and to measure the resulting loaded aperture polarizability (electric or magnetic), as is done in a dual TEM cell. Expressions are developed herein which relate these two configurations.

800,706
PB88-239447 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Automated System for Electromagnetic Field Generation and Immunity Testing.
Final rept.,
E. J. Vanzura. 1988, 8p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Instrumentation/Measurement Technology Conference, San Diego, CA., April 19-22, 1988, p3-10.

Keywords: *Electromagnetic fields, Electromagnetic testing, *Electromagnetic susceptibility, Probes(Electromagnetic), Computerized control systems.

An interactive computer-controlled system has been constructed for radiated immunity measurements. It can set up a desired unperturbed field strength at a point in space and simultaneously measure field strengths and polarizations at up to ten different positions. Field mapping experiments have been performed with the system in an anechoic chamber, a partially loaded shielded room, and an unloaded shielded room. Results confirm dramatic improvement in spatial field uniformity as more absorber is used. The frequency range of interest is 50 to 200 MHz because this is a particularly difficult frequency band in which to perform reliable immunity tests. The measurement system can be used in conjunction with many other facilities, such as a TEM cell, an open field site (ground screen) or a reverberating chamber, and can be used to test at frequencies from the low kHz up to 2 GHz.

800,707
PB88-239454 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
High Frequency Electric Field Probe Development.
Final rept.,
J. Randa, M. Kanda, D. Melquist, R. M. Sega, and J. D. Norgard. 1988, 7p
Sponsored by Naval Ocean Systems Center, San Diego, CA.
Pub. in Proceedings of International Conference on Electromagnetic Compatibility, Washington, DC., May 10-12, 1988, pT15.31-T15.37.

Keywords: *Electric fields, Electrical measurement, Temperature measurement, Fiber optics, Millimeter waves, *Probes(Electromagnetic), Superhigh frequency, Extremely high frequency, Sensors.

Various designs have been considered for electric-field probes for the frequency range 26-110 GHz. A fiber optic temperature sensor to detect the heating of a resistive strip was designed, built, and tested. With increased sensitivity, the design may be capable of operating throughout the range.

800,708
PB88-239546 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
International Comparison of Power Meter Calibrations Conducted in 1987.
Final rept.,
W. J. M. Moore, E. So, P. N. Miljanic, N. M. Oldham, and R. Bergeest. 1988, 2p
Sponsored by Institute of Electrical and Electronics Engineers, Inc., New York.
Pub. in CPEM '88 Digest, p341-342 1988.

Keywords: *Power meters, Wattmeters, Standards, Reprints, *Calibration, Interlaboratory comparisons.

The results of an intercomparison of power meter calibrations conducted during 1987 between the National Research Council, Ottawa, the National Bureau of Standards, Gaithersburg, and the Physikalisch Technische Bundesanstalt, Braunschweig, using a time-division multiplier watt-converter developed at the Institute Mihailo Pupin, Belgrade, are described. The measurements were made at 120 volts, 5 amperes, 50 and

60 hertz, at power factors of 1.0, 0.5 lead and lag, and 0.0 lead and lag. An agreement between the laboratories of better than 20 parts in a million is indicated.

800,709
PB88-239561 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Audio-Frequency Current-Comparator Power Bridge.
Final rept.,
N. M. Oldham, O. Petersons, and B. C. Waltrip. 1988, 1p
Pub. in CPEM '88 Digest, p48 1988.

Keywords: *Power measurement, Audio frequencies, Electric bridges, Comparator circuits, Reprints, Super-low frequency, Ultralow frequency, Very low frequency.

A system for performing active and reactive power measurements from 50 Hz to 20 kHz is described. The technique is an extension of a power bridge based on a current comparator capacitance bridge that was originally restricted to power frequencies. A digitally-synthesized dual-channel signal source provides the required voltage and current signals.

800,710
PB88-239579 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Accurate RF Voltage Measurements Using a Sampling Voltage Tracker.
Final rept.,
T. M. Souders, and P. S. Hetrick. 1988, 2p
Sponsored by Institute of Electrical and Electronics Engineers, Inc., New York.
Pub. in CPEM '88 Digest, p270-271 1988.

Keywords: *Voltage measuring instruments, Ultrahigh frequencies, Superhigh frequencies, Extremely high frequencies, Radio frequencies, Reprints, Sampling voltage trackers.

The rf voltage measurement capability of an equivalent time sampling system is described. The frequency range investigated is 1 to 100 MHz. Over this range, the measured errors, determined by ac/dc thermal transfer, are within the stated uncertainties presently provided by NBS for thermal converter calibrations. The system offers several advantages over conventional thermal transfer techniques: ac/dc transfers are not required, loading and transmission line problems are reduced, and direct measurement of voltages from 2 V to as low as 10 mV are possible.

800,711
PB88-243167 PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, October to December 1987, with 1988 CEE Events Calendar.
E. J. Walters. Jul 88, 28p NBSIR-88/3825
See also PB88-196530.

Keywords: *Bibliographies, Semiconductor devices, Electromagnetic interference, Signal processing, Semiconductors(Materials), Metrology, Microwaves, Electrooptics, Abstracts, *Electrical engineering, *Electronics.

This is the fifteenth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. The issue of the Center for Electronics and Electrical Engineering Technical Publication Announcements covers the fourth quarter of calendar year 1987. Abstracts are provided by technical area for papers published this quarter. Broad subject headings include the following: Semiconductor technology program; Fast signal acquisition, processing, and transmission; Electrical systems; Electromagnetic interference.

800,712
PB88-246715 (Order as PB88-246707, PC A04)
National Bureau of Standards, Gaithersburg, MD.

General

Improvement in the Reliability of Standard Cell Enclosures.

B. F. Field, and L. Ruimin. 18 Feb 88, 5p
Included in Jnl of Research of the National Bureau of Standards, v93 n4 p533-537 1988.

Keywords: *Temperature control, *Enclosures, Reliability(Electronics), Controllers, Ovens, *Standard cells, *Voltage standards.

The authors describe the design of a new temperature-regulation circuit, which is used as an outer oven controller for new standard cell enclosures, with the emphasis on improving the reliability of the temperature control. A redundant protection circuit is used to prevent loss of temperature control caused by component failures in the controller. The temperature control of the outer oven of the enclosure is better than 0.4 mK per deg C change in ambient temperature. When used with the additional inner controller the sensitivity of the cell temperature to the ambient temperature is improved to 20 micro K/deg C. The paper describes in detail the new circuit, summarizes the enclosure construction, and presents data on the performance of the system.

800,713

PB89-101455

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Surge Testing: Don't Kid Yourself, Don't Kill Yourself.

Final rept.,
F. D. Martzloff. 1988, 4p
Sponsored by Interference Control Technologies, Inc., Gainesville, VA.
Pub. in EMC Technology and Interface Control News 7, n5 p35-38 Jul/Aug 88.

Keywords: *Surges, *Tests, *Electromagnetic compatibility, Reprints, *Surge suppressors.

Increasing awareness of the sensitivity of electronics to surge effects has led to a proliferation of surge suppressors on the market. Confronted with a difficult choice, some users are evaluating the performance of these devices by surge testing. However, the techniques involved in these tests are different from typical EMC testing because of the single-shot nature of the event and because of the potential personnel hazards involved in surge testing. The article presents a brief overview of surge testing, focusing on the techniques required in performing valid tests under safe conditions.

800,714

PB89-101489

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Understanding Reverberating Chambers as an Alternative Facility for EMC Testing.

Final rept.,
M. T. Ma. 1988, 13p
Pub. in Jnl. of Electromagnetic Waves and Applications 2, n3/4 p339-351 1988.

Keywords: *Electromagnetic compatibility, *Test facilities, Electrical measurement, Electric fields, Reprints, *Reverberation chambers, Quality factors.

A relatively new facility called a reverberating chamber, designed for EMC testing, is described. The purpose is to create a statistically uniform electric field inside a metal enclosure for testing radiated susceptibility or immunity of equipment. Design criteria in terms of the number of cavity modes, mode density, and composite quality factor are presented in details in order to understand the physical insight and to enhance interpretations of measurement results. Recent experimental data are included to illustrate the underlying principle.

800,715

PB89-101505

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Josephson ac Voltmeter.

Final rept.,
R. L. Peterson, and N. M. Oldham. 1988, 7p
Pub. in Jnl. of Applied Physics 63, n10 p4804-4810, 15 May 88.

Keywords: *Voltmeters, Josephson junctions, Alternating current, Reprints, High temperature superconductivity, Voltage standards.

A new technique is proposed for accurate measurement of ac voltages with Josephson junctions. Based

on the counting of pulses generated by a Josephson junction, the method may be capable of precision at the ppm level for frequencies less than 100 kHz.

800,716

PB89-103683

PC A03/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.

Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, January to March 1988 with 1988 CEEE Events Calendar.

E. J. Walters. Jul 88, 34p NBSIR-88/3815
See also PB88-232913.

Keywords: *Electronics, *Electrical engineering, Metrology, Antennas, Semiconductor devices, Superconductors, Electromagnetic interference, Bibliographies.

The report is the twenty-second issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. The issue of the CEEE Technical Progress Bulletin covers the first quarter of calendar year 1988. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

800,717

PB89-107700

PC A03/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.

Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, January to March 1988 with 1988 CEEE Events Calendar.

E. J. Walters. Sep 88, 18p NBSIR-88/3854
See also PB88-232913.

Keywords: *Electronics, *Electrical engineering, *Bibliographies, Documents, Antennas, Electromagnetic interference, Fiber optics, Superconductors, Semiconductor(Materials), Metrology, Signal processing.

This is the sixteenth issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology (formerly the National Bureau of Standards) Center for Electronics and Electrical Engineering. The issue of the Center for Electronics and Electrical Engineering Technical Publication Announcements covers the first quarter of calendar year 1988. Abstracts are provided by technical area for papers published this quarter.

800,718

PB89-118962

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Calculation of Confidence Intervals for High-Voltage Impulse Reconstruction.

Final rept.,
J. Lagnese, and R. McKnight. 1988, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 37, n2 p201-206 Jun 88.

Keywords: *Confidence limits, *High voltage, *Pulsation, Construction, Reprints, Stochastic error bounds.

A recently described algorithm designed to calculate confidence intervals for solutions to ill-posed problems subject to inequality constraints is applied to the calculation of confidence intervals for a high-voltage impulse distorted by a divider system. Applications of the method to measurements made with resistive and capacitive dividers illustrate its value for obtaining useful stochastic error bounds for high-voltage impulse restoration.

800,719

PB89-123137

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD.

Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, April to June 1988, with 1988 CEEE Events Calendar.

E. J. Walters. Oct 88, 28p NISTIR-88/3866
See also PB88-243167.

Keywords: *Bibliographies, *Electrical engineering, *Electronics, Semiconductor(Materials), Electromagnetic interference, Signal processing, Metrology, Transmission, Microwaves, Electrooptics, Abstracts,

Superconductors, Fiber optics, Semiconductor devices.

This is the twenty-third issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology (formerly National Bureau of Standards) Center for Electronics and Electrical Engineering. This issue of the CEEE Technical Progress Bulletin covers the second quarter of calendar year 1988. Abstracts are provided by technical area for both published papers and papers approved by NIST for publication.

800,720

PB89-124101

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Tigers or Pussycats: Does Distance Make the Difference.

Final rept.,
F. D. Martzloff. 1988, 2p
Pub. in BICSI Newsletter 9, n2 p3-4 Oct 88.

Keywords: *Propagation, *Surges, Overcurrent, Electromagnetic radiation, Reprints.

Article to be included in the internal newsletter of a trade organization sponsoring work at NBS. Part 1 provides information on the organization of an informal consortium to sponsor the work and makes reference to an IEEE paper scheduled for presentation in September 1988. Part 2, to be submitted later, will describe further work.

800,721

PB89-126965

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Electricity Div.

10 V Round-Robin Test Conducted on a Solid-State DC Voltage Standard.

Final rept.,
L. S. R. Becker, B. F. Field, and T. E. Kiess. 1986, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-35, n4 p383-386 Dec 86.

Keywords: *Standards, *Electrical potential, Electrical measurement, Solid state devices, Avalanche diodes, Reprints, *Direct current.

A round-robin comparison of ten volt DC standards was conducted through the cooperative efforts of the U.S. Army Primary Standards Laboratory, U.S. Navy East and West Laboratories, U.S. Air Force Primary Standards Laboratory, and the National Bureau of Standards. A transfer uncertainty of 0.17 ppm (95% confidence interval) was obtained using solid-state DC voltage references. The paper describes the round-robin test, presents the results obtained on the evaluation of the transfer uncertainty of ten-volt solid-state standards, and provides information on the relative quality of various test methods used in this round-robin.

800,722

PB89-132310

PC A05/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electrosystems Div.

Research for Electric Energy Systems: An Annual Report (1987).

R. J. Van Brunt. Nov 88, 86p NISTIR-88/3886
See also PB88-113782. Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Electric power, Electric measuring instruments, Dielectrics, Dielectric breakdown, Ion currents, Electrical insulation, Sulfur hexafluoride, Measurement, Space charge, Insulating oil, Decomposition, Ion mobilities, Drift tube, Gaseous dielectrics, Liquid dielectrics.

The report summarizes the technical accomplishments during fiscal year 1987 from a U.S. Department of Energy sponsored program at the National Bureau of Standards to provide technical support for DOE's research on electrical energy systems. Major activities associated with each of the four subtasks that constitute the program are highlighted. These include research on: (1) physical field and ion measurements; (2) fundamental physical and chemical processes in commonly used gaseous dielectrics like SF₆; (3) development of advanced methods for observing and cataloging prebreakdown interfacial phenomena in liquid

dielectrics; and (4) evaluation of advanced methods for characterizing transient measurements by use of step response and convolution integrals as they apply to free standing dividers.

800,723

PB89-132880 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Collisional Electron Detachment Cross Section Measurements for SF₆(1-), SF₅(1-) and F(1-) in SF₆: Implications for Interpretations of Existing Ion Transport and Breakdown Probability Data.

Final rept.,
J. K. Olthoff, R. J. Van Brunt, Y. Wang, R. L. Champion, and L. D. Doverspike. 1988, 4p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of International Conference on Gas Discharge and Their Applications (9th), Venice, Italy, September 19-23, 1988, p363-366.

Keywords: *Sulfur hexafluoride, *Cross sections, *Meetings, Ions, Excitation, Mathematical models, Reprints, *Electron collisions, *Charge transport.

Collisional electron-detachment cross sections for SF₆(sup -1), SF₅(sup -1), and F(sup -1) on SF₆ target gas have been measured for relative (center-of-mass) energies in the range of 3 to 250 eV. Apparent thresholds for direct detachment are observed at 90 eV for SF₆(sup -1) and SF₅(sup -1), and at 8 eV for F(sup -1). Cross sections for ion-conversion processes that compete with detachment are reported and indicate the necessity to re-examine ion-conversion rates determined in SF₆ from drift-tube data. The measured cross sections are used in a theoretical model which invokes detachment from long-lived, energetically-unstable states of collisionally excited SF₆(sup -1) to explain the pressure dependence of previously measured detachment coefficients and the high detachment thresholds implied by analysis of breakdown-probability data for SF₆. The model indicates that at high pressure, measured detachment coefficients appear to depend primarily upon ion-conversion and direct detachment rates for processes involving F(sup -1).

800,724

PB89-132898 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Stochastic Properties of Negative Corona (Trichel) Pulses in SF₆/O₂ Mixtures.

Final rept.,
S. V. Kulkarni, and R. J. Van Brunt. 1988, 4p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of International Conference on Gas Discharge and Their Applications (9th), Venice, Italy, September 19-23, 1988, p227-230.

Keywords: *Sulfur hexafluoride, *Oxygen, *Stochastic processes, *Electric corona, *Meetings, Mixtures, Gas discharges, Reprints, *Corona discharges, Pulse rise time, Pulse amplitudes.

The statistical probability distributions of discharge pulse amplitude, P(sub 0) (q), pulse time interval, P(sub 0) (delta t), and pulse amplitude for a given time separation, delta t, from the previous pulse, P(sub 1) (q/delta t) have been measured for Trichel-type negative point plane corona in SF₆/O₂ gas mixtures as functions of point-to-plane voltage and mixture ratio. The results reveal significant, previously unrecognized correlations among the amplitudes and time intervals of successive discharge pulses which are consistent current theoretical descriptions of the phenomenon. As the SF₆ content in SF₆/O₂ mixtures is increased, the growth of negative corona pulses diminishes as reflected in lower mean pulse amplitudes and the pulses appear more randomly in time, i.e., there is a broadening of the pulse time-interval distributions.

800,725

PB89-136311 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.

Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, April to June 1988, with 1988 CEEE Events Calendar.

E. J. Walters. Nov 88, 16p NISTIR-88/3895
See also PB89-123137.

Keywords: *Bibliographies, *Electrical engineering, *Electronics, Semiconductor(Materials), Electromag-

netic interference, Metrology, Transmission, Microwaves, Electrooptics, Abstracts, Superconductors, Fiber optics, Semiconductor devices.

This is the seventeenth issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology (formerly the National Bureau of Standards) Center for Electronics and Electrical Engineering. The issue of the Center for Electronics and Electrical Engineering Technical Publication Announcements covers the second quarter of calendar year 1988. Abstracts are provided by technical area for papers published this quarter.

800,726

PB89-137582 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Statistics of Pit Initiation: Analysis of Current Transients during Passive Film Breakdown.

Final rept.,
U. Bertocci, S. Leigh, A. C. Van Orden, and G. Yang. 1987, 9p
Sponsored by Nuclear Regulatory Commission, Washington, DC.

Pub. in Proceedings of Scientific Basis for Nuclear Waste Management Conference, Boston, MA., December 1-4, 1986, p251-259 1987.

Keywords: *Pitting tests, *Electrical faults, Films, Passivity, Statistics, Variations, Electric current, Stochastic processes, Experimentation, Reprints.

During the incubation period preceding pitting, current fluctuations indicate the beginning of the breakdown of the passive film. The characteristics of these current transients are being examined as a possible way to predict pitting. Stochastic models applied to the breakdown process have been proposed, and in order to test how well they account for the experimental results, various form of processing of the current vs. time records are necessary. The paper describes the experimental data-taking methods, the processing routines so far developed for the statistical analysis of the data, and compares the experimental results with computer simulations based on a stochastic model.

ENERGY

Batteries & Components

800,727

PB89-119127 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Mathematical Model for the Pulsed Electrodeposition of Alloys.

Final rept.,
C. R. Beauchamp. 1985, 1p
Pub. in Jnl. of the Electrochemical Society 132, n8 pC352 1985.

Keywords: *Electrodeposition, *Lead, *Tin, *Electrodes, Mathematical models, Mass transfer, Kinetics, Polarography, Diffusion coefficient, Finite difference theory, Alloy plating, Reprints.

The object of the study is to develop a mathematical model based on one dimensional mass transport and kinetic considerations to predict alloy composition during the process of electrodeposition on a rotating disk electrode. One dimensional diffusion, migration and convection of each reactive species are considered. The differential equations governing mass transport are solved using a finite difference method. The boundary conditions for these equations are fixed by the Nernst diffusion layer thickness, and the reaction rates at the interface. Examples will be presented for a lead-tin system considering direct and pulsed current electrodeposition.

Electric Power Production

800,728

PB88-194949 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Power Quality Measurements: Bringing Order Out of Chaos.

Final rept.,
F. D. Martzloff. 1988, 13p
Sponsored by Government Institutes, Inc., Rockville, MD.
Pub. in Proceedings of Energy Technology Conference, Energy Technology XV 'Repowering America', Washington, DC., February 17-19, 1988, p947-959.

Keywords: *Electric power, Overvoltage, Standards, Surges, Site surveys, *Power quality.

The quality of the power supplied to sensitive electronic equipment is an important issue. Quantifying this quality, however, is difficult under the present state of nonexistent or uncoordinated standards concerning two related questions: (1) what levels of power quality are required for what types of loads; and (2) what measurement techniques are required to determine reliably the level of disturbances that reduce quality. Development of standards by the consensus process and voluntary compliance, although a slow process, is a mechanism for reaching technically sound and cost-effective solutions. Several standards projects are in progress, but need an industry-wide support to become the generally accepted basis for valid and useful measurements of power quality.

Electric Power Transmission

800,729

PB89-132906 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Electrical Fast Transient Tests: Applications and Limitations.

Final rept.,
F. D. Martzloff, and T. F. Leedy. 1988, 8p
Pub. in Proceedings of Industrial Applications Society Annual Petroleum and Chemical Industry Conference (35th), Dallas, TX., September 12-14, 1988, p1-8.

Keywords: *Power lines, *Meetings, Transmission lines, Standards, Performance evaluation, Attenuation, Process control, Reprints, *Electrical transients, *Data lines, International Electrotechnical Commission.

The Technical Committee TC 65 of the International Electrotechnical Commission (IEC) has promulgated a new document (IEC 80 -4) requiring demonstration of the immunity of industrial process control equipment to fast transients occurring in power and data lines. These fast transients contain high-frequency components, intuitively expected to suffer greater attenuation than the lower frequency components as they propagate along the lines. Quantifying this intuitive expectation provides a perspective on the severity of the situation and helps defining realistic test requirements. To that end, the paper describes specific measurements conducted for typical low-voltage power line configurations; modeling of the attenuation provides a tool for understanding the significance of the line parameters and extends the usefulness of results to general cases.

Fuels

800,730

PB88-175641 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Bioprocessing of Coal.

Final rept.,
G. J. Olson, and F. E. Brinckman. 1986, 9p
Sponsored by Electric Power Research Inst., Palo Alto, CA.
Pub. in Fuel 65, n12 p1638-1646 1986.

ENERGY

Fuels

Keywords: *Coal, *Organic compounds, *Desulfurization, *Microorganisms, Reviews, Evaluation, Surveys, Reprints, *Biological processes, *Literature surveys.

A computer-assisted survey and critical evaluation of the international literature on microbial transformations of coal and relevant organic compounds is being performed to establish candidate microorganisms and biological processes potentially applicable to coal bioprocessing. Based in part on the literature review the authors have undertaken preliminary laboratory experiments investigating potentially useful microbial coal processing reactions. The paper represents a preliminary abbreviated version of the year end report emphasizing the literature review and including concepts behind laboratory 'proof-of-concept' experiments in progress.

800,731

PB88-177035

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Heat Capacity of a Medium-Volatile Bituminous Premium Coal from 300 to 520 K. Comparison with a High-Volatile Bituminous Nonpremium Coal.

Final rept.,

R. A. MacDonald, J. E. Callanan, and K. M.

McDermott. 1987, 6p

Pub. in Energy and Fuels 1, n6 p535-540 1987.

Keywords: *Coal, Modelling, Reprints, *Heat capacity, Premium coal, Thermal decomposition, Weathering.

The results of heat capacity measurements on a premium sample of medium-volatile bituminous coal from the Upper Freeport seam in Pennsylvania are compared with those obtained earlier on a sample of high-volatile bituminous coal from the Juanita C seam in Colorado that had not received special handling to prevent oxidation. There are significant differences between the results for the two coals, which may be attributed to their different oxidation levels and rank. For the premium coal, the initial runs and repeat runs on a specimen gave essentially the same results, exhibiting a smooth rise in heat capacity with increasing temperature. For the nonpremium coal, only the repeat runs showed this normal heat capacity behavior; the initial runs on each specimen exhibited exothermic behavior. Moreover, there were considerable differences, both qualitative and quantitative, between the results on one set of specimens made up from the nonpremium coal sample and those on a second set of specimens of the same coal sample made up 18 months later, presumably due to weathering. The results have been fitted by Merrick's model for the thermal decomposition of coal, modified to treat the observed behavior in the lower temperature range (300-520 K) of the experiments.

800,732

PB88-177373

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Wood Heating Safety Research: An Update.

Final rept.,

R. D. Peacock. 1987, 21p

Sponsored by Consumer Product Safety Commission, Washington, DC., and Department of Energy, Washington, DC.

Pub. in Fire Technology 23, n4 p292-312 Nov 87.

Keywords: *Fireplaces, *Fire safety, Fire tests, Flues, Heating equipment, Stoves, Wood, *Chimneys, Creosote.

The Center for Fire Research at the National Bureau of Standards has been involved in research related to wood heating safety for more than seven years. Areas of interest have included: typical operating conditions of modern heating appliances, intensity and duration of chimney fires in factory-built and masonry chimneys, clearance reduction systems for protection of combustible walls and ceilings, and wall pass-through systems for connection of appliances to chimneys through combustible walls. The paper presents a review of research at NBS and elsewhere related to wood heating safety and provides an assessment of the impact of the research on the fire safe use of wood heating appliances. Extensive references of research related to solid fuel heating safety are included.

800,733

PB88-193990

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Processing Coal with Microorganisms.

Final rept.,

G. J. Olson, F. E. Brinckman, and W. P. Iverson.

1985, 16p

Sponsored by Electric Power Research Inst., Palo Alto, CA.

Pub. in Proceedings of Annual EPRI (Electric Power Research Institute) Contractors Conference on Coal Liquefaction (10th), Palo Alto, CA., April 23, 1985, EPRI-AP-4253-SR, p30.1-30.16 1985.

Keywords: *Coal, *Microorganisms, *Desulfurization, Organic compounds, Surveys, *Coal liquefaction, Biotechnology, Literature surveys, Computer applications.

A computer-assisted survey and evaluation of the international literature on microbial transformations of coal and relevant organic compounds was performed to identify candidate microorganisms and biological processes potentially applicable to coal bioprocessing. The vast majority of the literature on coal bioprocessing deals with desulfurization via pyrite removal, and some bioprocessing schemes have been proposed. Reports on organic S and metals removal from coal have recently appeared. As yet unevaluated are systems for removal of other elements from coal by microorganisms, such as O or N. However, model substrates resembling certain important O and N functional groups in coal are degraded by microorganisms. These microorganisms could be useful in coal bioprocessing. Our laboratory results suggest that a strain of Streptomyces, capable of vanillic acid decarboxylation, removes carboxyl groups from coal. The authors were not able to confirm literature reports of organic S removal from coal by Sulfolobus, or of coal liquefaction by certain fungi.

800,734

PB88-227731

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.

Oil Storage Tank Collapse at Ashland-Floeffe Terminal.

Final rept.,

R. N. Wright, and J. Smith. 1988, 3p

Pub. in Materials Evaluation, p587-589 Apr 88.

Keywords: *Oil storage, *Storage tanks, Collapse, Water pollution, Disasters, Reprints, Environmental impacts.

On Jan. 2, 1988, an oil storage tank in Pennsylvania's Ashland-Floeffe Terminal collapsed, spilling thousands of liters of diesel oil into the nearby Ohio River. The water supply of downriver communities was threatened, and some biologists have said it will take years for the river's ecosystem to recover. The following report suggests the current failure-prevention philosophy of regulating organizations. The philosophy emphasizes not nondestructive testing (NDT) but structural integrity through fail-safe design. The role of NDT within the context remains to be seen. For this particular disaster, the final post mortem and its implications for the NDT community may be many months away.

800,735

PB88-252911

PC A06/MF A01

National Bureau of Standards (ICST), Gaithersburg, MD.

Evaluation of Data Availability and Quality for Interaction Second Virial Coefficients of Use to the Gas Industry.

Technical note (Final),

B. J. Van Wie, M. A. Langenberg, W. C. W. Chang, K. H. Kumar, and K. E. Starling. Jul 88, 108p NBS/TN-1249

Also available from Supt. of Docs. as SN003-003-02881-9. Prepared in cooperation with Oklahoma Univ., Norman. School of Chemical Engineering and Materials Science.

Keywords: *Natural gas, *Manufactured gas, *Standards, Physicochemical properties, Binary systems (Materials), Thermodynamic properties, Equations of state, Ideal gas, Temperature coefficient, Tables (Data), Quality assurance, *Virial equation, Syngas process.

Binary interaction second virial coefficient information useful to the natural and syngas industries has been compiled and evaluated. An extensive literature search has been conducted to obtain publicly available information dating back to 1900. Assessments were made to determine data availability, quality and to summarize data needs. No evaluations were made for

values resulting from thermodynamic correlations; however, references containing such information are listed. Each binary gas system has been individually evaluated and references containing the highest quality and most abundant measurements have been listed in a table of recommended values.

800,736

PB89-122378

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Direct Measurement of Heat of Gasification for Polymethylmethacrylate.

J. L. Jackson. Oct 88, 39p NISTIR-88/3809

Prepared in cooperation with Armstrong World Industries, Lancaster, PA.

Keywords: *Measuring instruments, *Polymethylmethacrylate, *Combustion, Temperature, Burning rate, Pyrolysis, Thermal degradation, Fires, Vaporization, Heat transfer, Solid fuels, *Heat of gasification.

A laboratory scale apparatus has been developed for the direct measurement of the heat of gasification for solid fuels. The apparatus has been designed to simulate radiant energy transfer rates found under actual fire conditions and designed in such a way that the energy gains and losses with respect to the sample surfaces are well defined. Calculation of the time dependent heat of gasification for solid fuels relies on the ability to measure accurately and continuously the time dependent energy transfer rates and material responses. Tests have been conducted in which samples of polymethylmethacrylate were subjected to incident heat fluxes ranging from 1 to 4 W/sq cm. Test results indicate that under these conditions the heat of gasification is significantly influenced by the time dependent thermal properties of the material and approaches an asymptotic value that varies with incident heat flux. The asymptotic values decrease with increasing incident heat flux and approach a value of 1600 J/g which is consistent with values published by other investigators. Refinement of the apparatus and the testing of other materials is continuing. Results for two additional materials, fir and oak are included as Appendix A.

Heating & Cooling Systems

800,737

PATENT-4 789 779

Not available NTIS

National Inst. of Standards and Technology, Gaithersburg, MD.

Heat Pipe Oven Molecular Beam Source.

Patent,

R. E. Drullinger. Filed 9 Apr 87, patented 6 Dec 88, 8p PB89-135263, PAT-APPL-7-035 211

See also PB86-151727.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Ovens, *Patents, Molecular beams, Porous materials, Collimators, Temperature gradients, Substrates, Evaporation, Cavities, Heat pipes.

A recirculating oven molecular beam source of unitary construction comprises a shaped porous wicking oven substrate nearly saturated with the working material and having a cavity with source and collimating regions formed therein.

800,738

PB88-174792

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Importance of Including the Liquid Phase in Equations of State for Nonazeotropic Refrigerant Mixtures.

Final rept.,

G. Morrison. 1985, 14p

Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Transactions, v91 pt1B p260-273 1985.

Keywords: *Refrigerants, Liquid phases, Equations of state, Phase diagrams, Critical point, Physical properties, Reprints.

The recent surge of interest in nonazeotropic refrigerant mixtures has generated a need for correlation and prediction of liquid phase information for mixtures. The authors show that the ideal mixture assumption (the linear weighting of pure liquid properties) can be useful but can also be seriously in error when one of the components is near its critical point, even when the mixture is not near its own critical point. The authors also suggest that using spline-fits to data in isolation is an ineffective way of using such information. A physical model is suggested for a mixture whose equation of state incorporates all the departures of the mixture from ideality, which allows small, isolated sets of data to be used in predicting other physical properties of both the pure fluids and their mixtures.

800,739
PB88-175369 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.

Indoor Air Quality.

Final rept.,
P. E. McNall. 1986, 7p
Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Jnl. 28, n6 p39-42, 44, 46, 48 Jun 86.

Keywords: *Ventilation, *Residential buildings, *Office buildings, Reprints, *Indoor air pollution.

Recent trends, due to energy conservation practices, have reduced ventilation and infiltration in dwellings, offices, and other commercial (non-factory) buildings. These trends, as well as the introduction into buildings of new materials and machines, have increased levels of indoor contaminants. Investigations of many indoor environments reveal contaminant levels above those set as standards for workplace environments. The paper discusses the general status of the research in the United States and the planned future effort. World-wide research is also summarized.

800,740
PB88-175435 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.

Off-Cycle Energy Loss Measuring Methods for Vented Heating Equipment.

Final rept.,
E. R. Kweiler. 1985, 18p
Sponsored by Department of Energy, Washington, DC. Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Transactions 91, pt2B p773-790 1985.

Keywords: *Heating systems, *Space HVAC systems, Energy losses, Tracer techniques, Gases, Reprints.

A direct measurement method has been proposed as a potential alternative to the tracer gas technique now used to measure off-period energy loss of space heating equipment because the alternative does not require expensive tracer gas instrumentation. The method uses a controlled flow of gas to a small gas fuel burner to simulate normal flue or stack temperatures previously measured during a cool-down test. Energy metered through the gas burner during the simulation gives a direct measurement of the thermal energy losses out of the stack.

800,741
PB88-177662 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.

Experimental Comparison of Ammonia-Water and Ammonia-Water Lithium Bromide Mixtures in an Absorption Heat Pump.

Final rept.,
M. O. McLinden, and R. Radermacher. 1985, 10p
Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Transactions, v91 pt2B p1837-1846 1985.

Keywords: *Heat pumps, Performance, Ammonia, Water, Lithium bromides, Comparison, Tests, Reprints, *Absorption heat pumps.

The performance of an absorption heat pump (AHP) operating with ammonia-water and ammonia-water-lithium bromide mixtures is compared. The AHP was designed for the ammonia-water system but operated successfully and without modifications with the ternary system. The pressures and most of the temperatures showed only minor differences. The COP of the AHP operating with a ternary mixture having a LiBr/H₂O mass ratio of 0.48/0.52 was, on average, 0.05 lower

than with the binary system. However, several factors indicated that the refrigerant vapor entering the rectifier had a significantly lower water content with the ternary system, as predicted in the literature.

800,742
PB88-189931 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.

Effect of Short Cycling and Fan Delay on the Efficiency of a Modified Residential Heat Pump.

Final rept.,
W. J. Mulroy. 1986, 14p
Sponsored by Department of Energy, Washington, DC. Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Transactions, v92 pt1B p813-826 1986.

Keywords: *Heat pumps, *Residential buildings, *Air conditioners, Fans, Control, Cycles, Efficiency, Tests, Reprints.

The object of the study was to determine if the use of a cycling controller would improve the efficiency of a residential air conditioner or heat pump. Cyclic tests were performed on a capillary tube heat pump in three configurations: as manufactured, as modified to simulate a non-bleed expansion valve unit by operation of a valve in the liquid line, and as modified to simulate an air conditioner by elimination of the accumulator. The two modifications, the liquid line valve installation and accumulator removal, were found to greatly improve the cyclic performance to about equal levels; however, some cyclic losses remained. It was concluded that any control strategy that resulted in shortened on-cycle run times would reduce cyclic efficiency for all designs tested. It was further concluded, based in part on the work of others, that fan delay is an undesirable control strategy for units that have the indoor air handler and coil installed within the conditioned space.

800,743
PB88-192323 PC A05/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.

Users Guide to POST (Plant Operations Simulation Template).

G. E. Kelly, and D. R. Clark. Mar 88, 95p NBSIR-88/3740
Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Control heating plants, Boilers, Cooling towers, Heating equipment, Cooling systems, User manuals(Computer programs), Operations, Simulation, Efficiency, POST computer program.

A non-proprietary simulation template program named POST (Plant Operations Simulation Template) has been developed for use with the Lotus 1-2-3* spreadsheet. The template provides for mathematical simulation of central heating/cooling plant equipment including boilers, cooling towers, and centrifugal chillers. It provides methods for configuring a simulation of a specific physical plant, defining operating conditions and time-dependent boundary conditions, running simulations, and graphing simulation results. POST is a flexible and highly portable analytical tool for plant equipment operators and engineers concerned with efficient operation of physical plant systems. The Users Guide provides an overview of POST and its companion template program SETUP, which is used to define the characteristics of component models. Information is presented on the menu commands used in POST and three examples are provided. The examples show how the template program may be used to simulate the performance of a three-boilers heating plant and a central cooling plant consisting of two chillers and a cooling tower. Listings of the actual keystrokes for setting up and running both simulations are included.

800,744
PB88-192463 PC A08/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.

Flame Roll-Out Study for Gas Fired Water Heaters.

J. Y. Kao, D. B. Ward, and G. E. Kelly. Mar 88, 159p NBSIR-88/3724
Sponsored by Consumer Product Safety Commission, Washington, DC.

Keywords: *Water heaters, *Gas heaters, *Tests, Safety, Flues, Fire safety, Tables(Data), Standards, Pressure control, Performance, Draft(Gas flow).

Five gas-fired water heaters were tested in laboratory with simulated home conditions to evaluate their flame

roll-out characteristics. Simulated variables were flue blockage, space pressure depression, access door status and other related factors. Test results were compared with those based on the proposed American National Standards Institute (ANSI) test method. The testing concludes that, in addition to flue blockage, pressure depression and door status are major factors in inducing heater flame roll-out; that poor draft hood performance contributes to the likelihood of flame roll-out; that the proposed ANSI test method should add a temperature criterion for determining flame roll-out; that the proposed ANSI blocked flue test appears to be adequate for units equipped with thermal spill switches located at their access doors area. Recommendations are made that the Consumer Product Safety Commission (CPSC) and the ANSI subcommittee on water heaters consider also requiring the interlocking of access doors with water heater operation, the use of temperature sensing as a means of detecting flame roll-out, and the use of improved draft hood designs and draft hood performance testing to reduce the chances of flame roll-out.

800,745
PB88-218227 PC A05/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.

Recommended Procedure for Rating and Testing of Variable Speed Air Source Unitary Air Conditioners and Heat Pumps.

P. A. Domanski. May 88, 81p NBSIR-88/3781

Keywords: *Air conditioners, *Heat pumps, Ratings, Compressors, Speed, Capacity, Heating, Cooling, Residential buildings.

A procedure is presented for testing and rating variable speed, split residential air conditioners and heat pumps. The procedure is derived in part from existing procedures for single speed and two speed systems where these procedures could be applied, and introduces a new algorithm for representation of variable speed unit performance in the intermediate speed operation range. Analysis and background which led to the formulation of the procedure are included as well as calculation examples for the cooling and heating mode. The procedure has been prepared for the Department of Energy for consideration in the rule making process.

800,746
PB89-101331 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.

Dynamics of a Heating Coil Control Loop.

Final rept.,
D. R. Clark, and B. A. Boerresen. 1985, 17p
Sponsored by Department of Energy, Washington, DC. Office of Buildings and Community Systems, and Civil Engineering Lab. (Navy), Port Hueneme, CA. Pub. in Proceedings of CIB International Symposium on Performance of HVAC Systems and Controls in Buildings, Garston, England, June 18-19, 1984, p57-73 1985.

Keywords: *Heating coils, *Temperature control, *Heat exchangers, Heat transfer, Heating load, Computerized simulation, Reprints, *Closed loop control, HVAC systems, Control systems.

In a typical heating coil control loop, temperature control is often achieved by varying the hot water flow rate through the coil. An alternative approach is one in which a constant water flow rate is maintained through the coil, and temperature control is achieved by mixing hot supply water with a variable fraction of the cooler coil outlet water. The latter arrangement is the subject of the paper. Theoretical considerations and computer simulations, supported by experimental data, indicate that the dynamic response of such a system depends on a number of factors including the effectiveness of the coil, the characteristics of the control valve, the transport time around the coil loop, and the frequency at which the controller tends to oscillate. While the precise behavior of the system cannot be predicted in advance without performing detailed simulations or experiments, some general suggestions for the design and control of such systems are proposed.

800,747
PB89-123251 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.

ENERGY

Heating & Cooling Systems

POST: Plant Operations Simulation Template.

Final rept.,
D. R. Clark, and G. E. Kelly. 1988, 10p
Sponsored by Civil Engineering Lab. (Navy), Port Huene, CA.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v94 pt1 p1760-1769 1988.

Keywords: *Heating equipment, *Cooling systems, Cooling towers, Computerized simulation, Mathematical models, Heating load, Cooling load, Reprints, *Plant Operations Simulation Template, Energy consumption.

A nonproprietary simulation template named POST (Plant Operations Simulation Template) has been developed for use with a spreadsheet program. The template provides for mathematical simulation of central heating/cooling plant equipment including cooling towers and centrifugal chillers. It provides methods for configuring a simulation of a specific physical plant, defining operating conditions and time-dependent boundary conditions, running simulations, and graphing simulation results. POST is a flexible and highly portable analytical tool for plant equipment operators and engineers concerned with efficient operation of physical plant systems.

Miscellaneous Energy Conversion & Storage

800,748
PB88-194071 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

Ettringite: A New Material for Thermal Energy Storage.

Final rept.,
L. Struble, and P. Brown. 1985, 3p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Solar Buildings Conference, Washington, DC., March 18-20, 1985, p314-316.

Keywords: *Heat storage, Solar energy, Specific heat, Dehydration, *Ettringite.

Ettringite, a hydrated calcium aluminosulfate that forms during hydration of portland cement, appears to have good potential for passive solar energy storage. The specific heat of synthesized ettringite was 0.3 calories per gram per degree Celsius, providing good energy storage by sensible heat. Upon heating, ettringite undergoes a dehydration reaction. The change in enthalpy during the reaction was 140 calories per gram ettringite, providing excellent energy storage. However, the upper temperature of the dehydration reaction was 55 C, somewhat high for the material to have application for passive solar energy storage. Experiments are underway to reduce the dehydration temperature and to determine whether the reaction is reversible.

800,749
PB88-196795 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.

Diurnal Effectiveness of Phase Change Energy Storage Cylinders.

Final rept.,
M. E. McCabe. 1986, 9p
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.
Pub. in Proceedings of ASME (American Society of Mechanical Engineers) Solar Energy Conference (8th), Anaheim, CA., April 13-16, 1986, Solar Engineering 1986, p282-290.

Keywords: *Heat storage, Solar energy, *Phase change materials.

A thermal performance index, 'diurnal effectiveness', was used as a measure of thermal performance for a phase change energy storage system in a cylindrical configuration. The governing mathematical equations are presented and a numerical solution based on the enthalpy model was used to obtain the temperature distribution, surface heat flux and phase interface location in a reference system. The surface of the cylinder was subjected to a time dependent flux representing the 24-hour diurnal cycle of the sun, and the steady-periodic solution was investigated to determine the effect of cylinder size and fusion temperature on the

thermal performance of a passively charged/passively discharged energy storage system.

Policies, Regulations & Studies

800,750
PB88-164496 PC A14/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Office of Energy-Related Inventions.
Energy Related Inventions Program: A Joint Program of the Department of Energy and the National Bureau of Standards. Status Report October 1987.
Oct 87, 306p NBSIR-87/3673
Sponsored by Department of Energy, Washington, DC.

Keywords: *Inventions, *Energy, US DOE, US NBS.

A brief description of the Energy Related Inventions Program and of all inventions recommended by the National Bureau of Standards to the Department of Energy since the inception of the program, including a brief summary of the current status of each.

800,751
PB89-114037 PC A03/MF A01
National Bureau of Standards, Gaithersburg, MD.
Effect of Wall Mass on the Peak Sensible Heating and Cooling Loads of a Single-Family Residence,
D. M. Burch, G. N. Walton, B. A. Licita, K. Cavanaugh, and M. D. Klein. Oct 86, 33p NBSIR-86/3458
Sponsored by Electric Power Research Inst., Palo Alto, CA.

Keywords: *Heating load, *Cooling load, *Houses, *Energy conservation, Thermal insulation, Architecture, Walls, Temperature control, Heat transfer, *Thermal mass.

The effect of wall mass on the peak sensible heating and cooling loads of a single-family residence was investigated using a sophisticated computer program called the Thermal Analysis Research Program (TARP). The computer simulation accuracy was verified by comparing its predicted sensible heating and cooling loads to measured values for six test buildings each having different wall constructions at the National Bureau of Standards. Good agreement was obtained for the load comparisons. The computer program subsequently was used to simulate the performance of identical houses each having the following three insulated wall constructions: wood frame, conventional masonry (outside wall mass), and innovative masonry (inside wall mass). When the house was operated with fixed thermostat settings, the effect of wall mass on the peak sensible heating and cooling loads was found to be less than 11% for the climatic regions analyzed. Operating the typical house with a 10 deg F (5.6 deg C) night temperature setback during an 8-hour night period caused the daily peak sensible heating loads to be approximately twice those without setback.

800,752
PB89-123269 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.

Effect of Thermal Mass on Night Temperature Setback Savings.

Final rept.,
D. M. Burch, T. Jacobsen, W. L. Johns, G. N. Walton, and C. P. Reeve. 1984, 23p
Sponsored by Department of Energy, Washington, DC., and Electric Power Research Inst., Palo Alto, CA.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v90 pt2A p184-206 1984.

Keywords: *Energy conservation, *Walls, Thermodynamic properties, Masonry, Wood, Buildings, Computer simulation, Temperature measurement, Thermal insulation, Reprints, *Thermal mass, *Temperature setback.

A series of field experiments were carried out using four test buildings to investigate the effect of wall mass on the heating energy savings achieved by night temperature setback. The test buildings were identical with the exception of the wall construction which was as follows: insulated wood frame, insulated masonry (exterior) mass, log, and insulated masonry (interior

mass). When weekly heating loads were plotted with respect to average outdoor temperature, the only effect caused by night setback was a reduction in the balance-point temperature. Variability in measured test results precluded determining whether differences in wall construction caused statistically significant set back savings. However, computer simulations using the TARP program indicated that the heavyweight test buildings had smaller setback savings than the lightweight test buildings.

800,753
PB89-127534 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Discrete Thermal Analysis Method (DTAM) for Building Energy Simulation with DTAM1 Users Manual,
J. Axley. Oct 88, 80p NISTIR-88/3868
Prepared in cooperation with Cornell Univ., Ithaca, NY.
Sponsored by Department of Energy, Washington, DC.

Keywords: *Computer software, *Thermal analysis, *Manuals, Computer simulation, Heat transfer, Convection, Steady state, Unsteady state, *DTAM1, *Building energy simulation, Finite element method.

DTAM1 is a general purpose building energy simulation based upon discrete analysis techniques, including, but not limited to, the Finite Element Method, used in other fields of physical simulation. It is the product of a first phase of development of Discrete Thermal Element Analysis Techniques for Building Energy Simulation that are expected to provide a means to unify existing building energy simulation theory. DTAM1 provides a library of discrete thermal elements, that may be assembled to model thermal systems idealized to have constant material and heat transfer properties (i.e., linear idealizations), including: 1D two-node thermal resistance elements; single-node lumped capacitance elements; two-node fluid flow loop element; 1D two-to-four node isoparametric conduction Finite Elements; 2D four-node isoparametric conduction Finite Elements (planar and axisymmetric).

800,754
PB89-141154 PC A14/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Energy Related Inventions Program: A Joint Program of the Department of Energy and the National Institute of Standards and Technology. Status Report October 1988,
F. L. Hart. Oct 88, 308p NISTIR-88/4005
Supersedes PB88-164496. Sponsored by Department of Energy, Washington, DC.

Keywords: *Inventions, *Energy, Conservation, US DOE, US NIST, Supplying, *Renewable energy sources, *Energy conservation, *Energy conversion, Commercial energy, Technology utilization.

A brief description of the Energy Related Inventions Program and of all inventions recommended by the National Institute of Standards and Technology (formerly the National Bureau of Standards) to the Department of Energy since the inception of the program, including a brief summary of the current status of each.

Solar Energy

800,755
PB88-194972 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.

Solar Collector Materials Durability Testing Procedures.

Final rept.,
D. Waksman. 1985, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Solar Building Conference, Washington, DC., March 18-20, 1985, p66-70.

Keywords: *Standards, Solar heating, Durability, Reliability, *Solar collectors, Flat plate collectors, Solar cooling systems, Test methods.

One of the major barriers to the use of new materials in solar heating and cooling systems is the lack of information about their long term performance. The National Bureau of Standards (NBS), with financial support

from the U.S. Department of Energy, has been conducting research to help generate the data required to develop methods for predicting the long term durability and reliability of flat-plate solar collectors and their materials. The paper presents: (a) an overview of key features of American Society for Testing and Materials (ASTM) solar collector durability related standards based on the work; (b) summarizes revisions currently being made by ASTM to several of these standards as a result of further research; and (c) discusses current NBS efforts to develop service life prediction techniques using reliability theory.

800,756
PB89-123244 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
Solar Collector Durability Evaluation by Stagnation Temperature Measurements.
Final rept.,
A. G. Dawson, W. C. Thomas, and D. Waksman.
1983, 9p
Pub. in Jnl. of Solar Energy Engineering, Transactions of the ASME (American Society of Mechanical Engineers) 105, n3 p259-267 Aug. 1983.

Keywords: *Durability, *Thermal degradation, Absorptance, Emittance, Transmittance, Thermal conductivity, Thermal insulation, Mathematical models, Reprints, *Solar collectors.

An analytical and experimental investigation was undertaken to evaluate an alternate method of measuring the thermal degradation of materials used in flat-plate collectors. This test method is based on measuring the temperature of the absorber under a no-flow condition before and after prolonged exposure. The primary material properties of interest are cover transmittance, solar absorptance and infrared emittance of the absorber, and thermal conductivity of insulation. The advantages and limitations of the proposed test method are compared with those for the currently used method which is based on measuring the energy output from collectors. Experimental results from both outdoor and indoor tests are presented. Steady-state and transient analytical models are developed to evaluate the proposed test method and interpret experimental results. The investigations show that the proposed method is more sensitive to small changes in collector material properties than is the currently used method.

ENVIRONMENTAL POLLUTION & CONTROL

Air Pollution & Control

800,757
PB88-189253 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Economic Effects of Materials Degradation.
Final rept.,
E. Passaglia. 1986, 13p
Pub. in ACS (American Chemical Society) Symposium Series 318, p384-396 1986.

Keywords: *Cost analysis, Reprints, *Acid rain costs, Air pollution, Corrosion, Fractures, Degradative processes, *Materials degradation.

When materials are placed into service they are subject to a number of degradative processes, examples of which are corrosion, wear, fatigue, fracture, U-V degradation, mildew and rot. These degradative processes cause the producers and users of durable goods to incur costs for special materials, for maintenance, repair and early replacement. On a national level, these costs have an economic effect in that they represent resources in the form of materials, capital, energy and labor that in the absence of these degradative processes could be used for other purposes. Using corrosion and fracture as examples, a method

for accounting for these effects, and their magnitude, will be discussed, as well as the relevance to the economic effects of acid rain on materials.

800,758
PB88-189741 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Measuring Hazards of Products of Combustion from Electrical Systems.
Final rept.,
J. E. Snell. 1987, 2p
Pub. in Fire Jnl. 81, n5 p108-109 Sep/Oct 87.

Keywords: Reprints, *Electrical fire safety, Electrical systems, Hazard analysis, Smoke toxicity, *Combustion products.

No abstract available.

800,759
PB88-189980 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Global Soot Growth Model.
Final rept.,
G. W. Mulholland. 1986, 10p
Sponsored by Consumer Product Safety Commission, Washington, DC.
Pub. in Proceedings of the International Symposium on Fire Science Safety (1st), Gaithersburg, MD., October 7-11, 1985, p709-718 1986.

Keywords: Surface growth, *Coagulation, *Free radical, Nucleation, Shock tube, Size distribution, *Soot.

Analytical results for soot concentration, average particle size, and sigma of the size distribution are obtained for a free radical soot growth model which includes a constant nucleation source, growth, and coagulation. Results are obtained with and without coagulation included and for a size independent growth rate as well as growth rate proportional to the surface area. Neither this model, nor a nucleation pulse model is able to account for all the results on soot formation for shock tube and pyrolysis experiments.

800,760
PB88-209945 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
CFCs (Chlorofluorocarbons): Is the Sky Falling. Quest for Alternatives.
Final rept.,
M. O. McLinden, and D. A. Didion. 1988, 11p
Sponsored by American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA. Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Jnl., p32-42 Dec 87.

Keywords: *Refrigerants, *Air pollution, Chlorohydrocarbons, *Chlorofluorocarbons, *Greenhouse effects, *Ozone depletion.

The objectives of the article are to present the criteria required of a refrigerant, discuss the reasons why CFCs (chlorofluorocarbons) were originally investigated as refrigerants (reasons which also make them the most promising in the search for alternatives) and finally to demonstrate that the inevitable tradeoffs among the various alternatives can be treated in a systematic way.

800,761
PB88-215157 PC A05/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Products of Wood Smolder and Their Relation to Wood-Burning Stoves.
T. Ohlemiller, and W. Schaub. May 88, 92p NBSIR-88/3767
See also PB85-226520. Sponsored by Department of Energy, Washington, DC.

Keywords: *Stoves, *Gasification, *Air pollution, *Pyrolysis, *Wood, Combustion products, Gas chromatography, Chromatographic analysis, Heating equipment, *Wood burning appliances, *Air pollution detection, Path of pollutants, Solid wastes.

The smoldering combustion of solid wood is a process pertinent to both fire safety and to the generation of air pollutants in wood burning stoves. The wood sample was in the form of a U-shaped channel 74 cm long with 6.4 cm thick walls. Smoldering propagated in the same

direction as the airflow (forward smolder). Tests were conducted with both red oak and white pine and both woods behaved quite similarly. In separate tests the air flow velocity was varied from about 9 to 22 cm/sec. At the low end of this range, the smoldering process was prone to extinction; at the high end it was increasingly likely to transition into flaming combustion. The smolder velocity, peak temperature, rate of heat and product evolution all increased over this flow range in an essentially linear manner. Analysis of the temperature profiles in the wood pointed to a dominance of radiative transfer in the smolder propagation process at low air flow rates and roughly equal roles for radiation and convection at higher flow rates.

800,762
PB88-236716 PC A06/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
Progress Toward a General Analytical Method for Predicting Indoor Air Pollution in Buildings: Indoor Air Quality Modeling Phase 3 Report.
J. Axley. Jul 88, 125p NBSIR-88/3814
Sponsored by Environmental Protection Agency, Washington, DC., Department of Energy, Washington, DC., and Consumer Product Safety Commission, Washington, DC.

Keywords: Contaminants, Predictions, Mathematical models, Air circulation, Dispersions, Analysis(Mathematics), Manuals, Computer programs, *Indoor air pollution, *Environmental transport, Confined environments, Tracer studies, Path of pollutants.

The interim report presents the results of Phase III of the National Bureau of Standards General Indoor Air Pollution Concentration Model Project. It describes: (a) a general element-assembly formulation of multi-zone contaminant dispersal analysis theory that provides a general framework for the development of detailed (element) models of mass transport phenomena that may affect contaminant dispersal in buildings; (b) an approach to modeling the dispersal of interactive contaminants involving contaminant mass transport phenomena; (c) an approach to modeling the details of contaminant dispersal driven by convection-diffusion processes in one-dimensional flow situations (e.g., HVAC ductwork); and (d) the features and use of CONTAM87, a program that provides a computational implementation of the theory and methods discussed. Equations governing contaminant dispersal in the whole building air flow system due to air flow and reaction or sorption mass transport phenomena are formulated by assembling element equations, that characterize a specific instance of mass transport in the building air flow system.

800,763
PB89-107726 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.
Environmental Effects of Oil Spill Combustion.
D. Evans, G. Mulholland, D. Gross, H. Baum, and K. Saito. Sep 88, 52p NISTIR-88/3822
Prepared in cooperation with Kentucky Univ., Lexington. Dept. of Mechanical Engineering. Sponsored by Minerals Management Service, Reston, VA.

Keywords: *Tanker ships, *Water pollution control, *Air pollution control, Combustion products, Smoke, Nitrogen oxides, Fires, Environmental surveys, Plumes, Concentration(Composition), Chemical analysis, *Oil spills, *Air toxic substances, Risk assessment.

Experimentation and analysis have been performed to quantify the combustion of crude oil on water. The burning behavior of three crude oils -- ALBERTA SWEET, LA ROSE, and MURBAN, were studied using 1.2 m diameter pool burns; in 0.6 m diameter pool fires using ALBERTA SWEET, combustion products were collected for extensive chemical analysis. The analysis showed that about 10% of the crude oil was converted to smoke in the combustion process. The CO concentration was a factor of 25 lower than the primary gaseous product CO₂, and the emission of NO and NO_x were less than one thousandth the concentration of CO₂. The PAH content of the smoke was enriched in the larger molecular weight species in comparison with the original fuel. A methodology was developed with which the down wind dispersal of smoke generated by one or more oil spill fires in close proximity may be predicted.

ENVIRONMENTAL POLLUTION & CONTROL

Air Pollution & Control

800,764

PB89-132765

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.

Multi-Zone Contaminant Dispersal Analysis Using an Element Assembly Approach.

Final rept.,

J. Axley. 1988, 26p

Sponsored by Department of Energy, Washington, DC., Environmental Protection Agency, Washington, DC., and Consumer Product Safety Commission, Washington, DC.

Pub. in Proceedings of AIVC (Air Infiltration and Ventilation Centre) Conference (9th), Novotel, Gent, Belgium, September 12-15, 1988, p1-26.

Keywords: *Air pollution, *Dispersion reactions, *Atmospheric diffusion, *Mathematical models, *Houses, Computerized simulation, Computer systems programs, Mass transfer, Predictions, Equations of motion, *Path of pollutants, *Indoor air pollution.

An element-assembly formulation of multi-zone contaminant dispersal analysis theory is described. In this approach, a flow system is idealized as an assemblage of mass transport elements that model specific instances of contaminant mass transport in the flow system. Equations governing the mass transport phenomena modeled by each element are expressed in terms of contaminant concentration variables that approximate the contaminant concentration at discrete points in the flow system. The imposition of conservation of mass allows these element equations to be assembled to form spatially discrete but temporally continuous equations that govern the system as a whole. Solution options are outlined, examples of application are presented, and a family of computer programs that provide one implementation of the theory is briefly described.

Radiation Pollution & Control

800,765

PB88-177514

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Investigation of Matrix Effects and Isotope Dilution in SIRIS (Sputter-Initiated Resonance Ionization Spectroscopy) Measurement of Uranium in Soils.

Final rept.,

J. M. R. Hutchinson, K. G. W. Inn, J. E. Parks, D. W. Beekman, M. T. Spaar, and W. M. Fairbanks. 1987, 7p

Pub. in Nuclear Instruments and Methods in Physics Research B26, p578-584 1987.

Keywords: *Boron, *Soils, Vanadium, Measurement, Radioactivity, Resonance ionization, Sputtering, Uranium, Reprints, *Mass spectrometry.

The characteristics of sputter-initiated resonance ionization spectroscopy (SIRIS) for determining trace uranium concentrations in soils are investigated. Although, presently, the most formidable problem in the assay of environmental materials with SIRIS is the low sensitivity of the system, the authors have chosen to focus on matrix effects as possible limiting factors in the paper. Separate active efforts are being made to improve sensitivity and isotopic selectivity in RIS systems. Electrically conducting solid samples compatible with high vacuum are made by compacting soil with 15% or greater graphite binder. It is found that matrix effects on the absolute uranium SIRIS signals can be as large as two orders of magnitude, precluding a direct comparison of uranium concentrations through uranium SIRIS signal levels. The method of isotope dilution is also explored. Systematic errors caused by different molecular forms or different microscopic physical locations of the two isotopes are less than 30% in this method. It is found that for samples in which these effects are minimized, the capability of the instrument is such that uranium concentrations can be determined successfully to better than 10% accuracy.

Solid Wastes Pollution & Control

800,766

PB89-127070

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Microbial Intervention in Trace Element Containing Industrial Process Streams and Waste Products.

Final rept.,

G. J. Olson. 1986, 20p

Pub. in Importance of Chemical Speciation in Environmental Processes, p493-512 1986.

Keywords: *Water pollution, *Microorganisms, *Industrial wastes, *Waste treatment, *Hazardous materials, Organometallic compounds, Metabolism, Methylation, Beneficiation, Coal, Minerals, Mining, Reprints, *Heavy metals, *Biotransformation, Energy metabolism.

Microorganisms are important agents in solubilization, precipitation, accumulation, and alkylation-dealkylation reactions involving heavy elements in environments associated with industrial process streams and wastes. Such microbial processes may be harmful or beneficial. Microbial resistance to toxic heavy elements often involves metabolic mechanisms causing changes in chemical speciation. With certain bacteria, heavy elements may serve as metabolic energy sources. The chemical speciation of heavy elements in these environments is critical in understanding the mechanisms of microbial heavy element transformations and optimizing or inhibiting these processes for industrial application and environmental assessment.

Water Pollution & Control

800,767

PB88-189790

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Determination of Genotoxic Polycyclic Aromatic Hydrocarbons in a Sediment from the Black River.

Final rept.,

W. R. West, P. A. Smith, G. M. Booth, S. A. Wise, and M. L. Lee. 1986, 9p

Pub. in Archives of Environmental Contamination and Toxicology 15, n3 p241-249 1986.

Keywords: *Water pollution, Gas chromatography, Mass spectrometry, Reprints, *Mutagenesis, Polycyclic aromatic hydrocarbons, Sediment analysis, Liquid chromatography.

Polycyclic aromatic hydrocarbons (PAH) have been identified as genotoxic pollutants in sediment from the Black River where a high incidence of hepatoma was observed in brown bullhead catfish (*Ictalurus nebulosus*). Subfractions of PAH based on the number of aromatic carbons were isolated from the PAH fraction of a Black River sediment extract. Ten fractions were analyzed by capillary column gas chromatography-mass spectrometry and tested for mutagenicity using the Ames assay and for induction of unscheduled DNA synthesis (UDS) in primary rat hepatocytes. The Ames assay indicated significant mutagenic activity in fractions which contained PAH with 4-6 aromatic rings; the majority of the activity was found in the fraction composed of 5-ring compounds. UDS was also significant in the same fractions, although the greatest genotoxicity was observed in the catacondensed and pericondensed 4-ring fractions which contained a large amount of alkylated-PAH.

800,768

PB89-132997

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Implications of Molecular Speciation and Topology of Environmental Metals: Uptake Mechanisms and Toxicity of Organotins.

Final rept.,

F. E. Brinckman, G. J. Olson, W. R. Blair, and E. J. Parks. 1988, 14p

Sponsored by Office of Naval Research, Arlington, VA. Pub. in Aquatic Toxicology and Hazard Assessment, ASTM STP 971, v10 p219-232 1988.

Keywords: *Organometallic compounds, *Tin organic compounds, *Toxicity, *In vivo analysis, Absorption(Biology), Chemical analysis, Water pollution, Aquatic microbiology, Mathematical models, Re-

prints, *Structure activity relationships, Risk assessment, Persistence, Path of pollutants.

The report compares predictions of environmental fate and effect parameters derived from quantitative structure-activity relationships using estimates of molecular total surface area (TSA) with experimental data. Organotins are used as an example. In addition, a simple linear free-energy relationship with TSA is demonstrated to be applicable to organotin aqueous solubility, chromatographic retentivity, octanol-water partition coefficients and bacterial uptake, and aquatic toxicity. New measurement methodology providing nondestructive optical imaging, in vivo, of tin employing a fluorescent, tin-specific ligand (3-hydroxyflavone) is used to evaluate a likely mechanism of uptake for triorganotins on cells. Finally, the laboratory results are extended to preliminary appraisal of environmental persistence of tributyltin, which involves both uptake and degradation processes.

General

800,769

PB88-194006

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.

Assessment of Measurement Uncertainty: Designs for Two Heteroscedastic Error Components.

Final rept.,

W. S. Liggett. 1988, 18p

Pub. in Principles of Environmental Sampling, p191-208 1988.

Keywords: *Quality assurance, *Environmental surveys, *Sampling theory, Reprints, Uncertainty.

Specification of quality assurance samples is discussed for sampling and measurement error having two independent, heteroscedastic components. Each component is heteroscedastic because its standard deviation depends on concentration. This error model is appropriate for environmental studies in which the samples are measured in several batches and the sample concentrations vary widely. The design considered specifies that a duplicate of a routine sample and two reference samples be included in each batch. Some batches have reference samples with the same concentration; others do not. The adequacy of this design depends on the number of batches, on the relative sizes of the within-batch and among-batch error components, and on the concentrations in both the samples of interest and in the quality assurance samples.

800,770

PB88-219951

PC A10/MF A01

National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.

Progress in Environmental Specimen Banking.

Special pub. (Final),

S. A. Wise, R. Zeisler, and G. M. Goldstein. Apr 88, 221p NBS/SP-740

Also available from Supt. of Docs. as SN003-003-02868-1. Library of Congress catalog card no. 88-600530. Sponsored by Health Effects Research Lab., Research Triangle Park, NC.

Keywords: Quality assurance, Contaminants, Chemical analysis, *Specimen banking, *Environmental samples, Environmental monitoring, Air sampling.

In the past decade, interest in the concept of specimen banking for the archiving of biological and environmental samples for future analysis has increased significantly, and specimen banking is now recognized as an integral part of systematic environmental monitoring. In recent years representatives of similar programs in Japan, Canada, and Sweden have joined in these meetings to expand the exchange of information. The 10th U.S.-German Seminar of State and Planning on Environmental Specimen Banking was held. At the meeting the current status of specimen banking activities in the U.S., FRG, Canada, and Japan was presented and discussed. The publication contains the proceedings of that meeting with contributions describing various activities related to banking and analysis of samples from aquatic, atmospheric, terrestrial, and human monitoring programs.

INDUSTRIAL & MECHANICAL ENGINEERING

Industrial Safety Engineering

800,772
PB88-164223 PC A05/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Quick Response Sprinklers In Office Configurations: Fire Test Results.
W. D. Walton, and E. K. Budnick. Jan 88, 85p
NBSIR-88/3695
Sponsored by General Services Administration, Washington, DC., and Fire Administration, Emmitsburg, MD.
Keywords: *Office buildings, *Sprinkler systems, Fire tests, Burning rate, Toxicity, Room fires, Compartment fires.

A series of fire tests in several typical office occupancy configurations were conducted in order to address the use of quick response sprinkler technology. These tests included (1) heat release rate tests, (2) compartment fire tests and (3) a large office test. The heat release rate tests were designed to characterize the burning rates of a computer work station and open shelf office storage. The compartment fire tests were designed to examine the effectiveness of quick response sprinklers in typical office fires involving a computer work station or an open office module.

800,772
PB88-169883 PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Prediction of Response Time of Smoke Detectors In Enclosure Fires.
Final rept.,
Y. Yamauchi. Jan 88, 52p NBSIR-88/3707
Sponsored by Hochiki Corp., Tokyo (Japan).
Keywords: *Smoke detectors, *Reaction time, Fire tests, Enclosures, Computerized simulation, Room fires.

In order to predict the response time of smoke detectors in enclosure fires, a computational model is developed for calculating the local particulate concentration near the ceiling. The large scale smoke movement is approximated by integral equations for plume and ceiling-jet, which originates in the cold lower layer and penetrates into the accumulated smoke layer in the upper portion of enclosure. The effect of coagulation, which changes the particle size distribution, is included to enable predictions of ionization smoke detector response. This engineering model is designed to be used in combination with two-layer zone models for obtaining more detailed information of smoke concentration in the upper layer.

800,773
PB88-198890 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Salt Water Modeling of Fire Induced Flows In Multi-compartment Enclosures.
Final rept.,
K. D. Steckler, H. R. Baum, and J. G. Quintiere. 1986, 7p
See also PB86-196417. Sponsored by David Taylor Research Center, Bethesda, MD.
Pub. in Proceedings of International Symposium on Combustion (21st), Munich, West Germany, August 3-8, 1986, p143-149.

Keywords: *Model tests, Flow visualization, Salt water, Smoke, Buoyancy, Enclosures, *Fire models, Compartment fires.

Salt water modeling is used to study fire-induced flows in multicompartment structures. Scaling laws relating salt water flows and hot gas flows are developed. Results from 1/20 scale salt water simulations of fire-in-

duced flows in a single-story multiroom structure are shown to be in good agreement with available full-scale results. Experiments involving a 1/20 scale model of a U.S. Navy ship demonstrate the feasibility of using the technique to study hot gas flows in compartmented structures too complex to study economically by other means.

Laboratory & Test Facility Design & Operation

800,774
PB88-173968 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Accuracy of Low Flow Rate Gas Calibrations at the National Bureau of Standards.
Final rept.,
J. Potzick. 1986, 6p
Pub. in ISA (Instrument Society of America) Transactions 25, n2 p19-24 1986.

Keywords: *Gas flow, *Calibrating, Test facilities, Pistons, Cylinders, Flow rate, Measurement, Reprints.

The sources of uncertainty in the low flowrate airflow calibration facility at the National Bureau of Standards have been reevaluated. The largest source of flowrate error lies in temperature measurement, where a point temperature transducer is used to measure the temperature of flowing gas in the system. An alternative method is being evaluated in which the average temperature of all the gas inside a piston prover cylinder is measured acoustically. Uncertainties in temperature and molecular weight, the two largest current error sources, are replaced by uncertainties in specific heat ratio and acoustic wavelength can be measured with relative accuracy better than 200 ppm. There is additional substantial improvement due to the volume-average nature of the acoustic measurement.

800,775
PB88-174826 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Temperature and Pressure Div.
Vacuum Gaging - Problems and Possibilities.
Final rept.,
C. R. Tilford. 1986, 8p
Pub. in Vuoto Scienza e Tecnologia 16, n2 p95-102 Jan-Jun 86.

Keywords: *Vacuum gages, Ionization gages, Gas analysis, Manometers, Reprints.

The work reviews the characteristics of commonly used vacuum gages, most notable capacitance diaphragm gages, hot filament ionization gages, and spinning rotor gages, as well as briefly discusses residual gas analyzers. Procedures to optimize performance are discussed as well as the influence of unusual measurement environments, such as magnetic fields, nonambient temperature differences, and radioactive gases.

800,776
PB88-175054 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Gas and Particulate Science Div.
Intercomparison of Fundamental Parameter Inter-element Correction Methods. Part 2.
Final rept.,
P. A. Pella, G. Y. Tao, and G. Lachance. 1986, 8p
Pub. in X-Ray Spectrometry 15, n4 p251-258 1986.

Keywords: Comprehensive, Intercomparison, X rays, Reprints, Algorithm, Alpha coefficients, *Fundamental parameters.

In the work, an intercomparison of fundamental parameter methods for correction of interelement effects in quantitative x-ray spectrometric analysis is extended to include a recently developed algorithm proposed by Lachance. The Lachance algorithm which the authors refer to as COLA uses alpha-coefficients calculated from first principles and then used to correct the results of elemental analysis for x-ray absorption/enhancement effects in bulk specimens. For first principle calculations, knowledge of the x-ray tube output spectral distribution is required. In the work the authors also compared results obtained using different sources of x-ray tube spectral distributions such as

measured spectra from the literature and spectra calculated from an NBS algorithm. Results of the analysis of selected alloys, minerals, and fused specimens are presented and critically examined.

800,777
PB88-175450 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Analytical Chemistry.
Quest for Quality Assurance.
Final rept.,
J. K. Taylor. 1985, 1p
Pub. in American Laboratory 17, n10 p67 1985.

Keywords: *Quality assurance, *Chemical analysis, Quality control, Measurement, Reprints, Reference materials.

The need for quality assurance of measurement data is discussed, and elements of a viable program for its achievement are outlined. The practical question of how much formal quality assurance is feasible in various measurement situations is addressed, and guidance is presented for the development of credible programs. A suggested quality assurance code of ethics for analytical chemistry laboratories is offered.

800,778
PB88-175468 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Analytical Chemistry.
Principles of Calibration.
Final rept.,
J. K. Taylor. 1987, 5p
Pub. in ASTM (American Society for Testing and Materials) Special Technical Publication, Sampling Calibration Atmos. Meas. 957, p14-18 1987.

Keywords: Chemical analysis, Quality assurance, Standardization, Measurement, Errors, Reprints, *Calibration, Uncertainty.

Measurement consists in the comparison of samples of unknown composition with standards of known composition or with scales calibrated with respect to such standards. The standards used must simulate the unknowns with respect to matrix and level of analyte if the comparisons are to be valid. The paper reviews the fundamental aspects of calibration, describes various approaches that may be used, and considers the sources of error in the calibration process. The evaluation of calibration uncertainty and ways to minimize it are discussed. A general discussion of linear relationships as applied to calibration is presented.

800,779
PB88-176656 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Para-Flex Stage for Microtopographic Mapping.
Final rept.,
E. C. Teague, R. D. Young, F. Scire, and D. Gilsinn. 1988, 7p
Pub. in Review of Scientific Instruments 59, n1 p67-73 Jan 88.

Keywords: Pivots, Precision, Reprints, *Microtopographic mapping.

The design and performance of a high-precision X-Y stage which uses a unique type of flexure pivots, is described. Performance achieved with a symmetrical arrangement of four arm/pivots for each axis is such that pitch, roll, and yaw is less than one arc-second for one millimeter by one millimeter stage motion. Vertical vibration during stage motion is less than 2.5 nm peak-to-valley, with the major limitation being insufficient decoupling from the drive mechanism. Also described is application of the stage for performing microtopographic mapping with a stylus transducer.

800,780
PB88-176839 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Temperature and Pressure Div.
We Do Have Vacuum Gage Calibration Standards.
Final rept.,
C. R. Tilford. 1986, 8p
Pub. in Research and Development 28, n5 p105-112 Mar 86.

Keywords: *Vacuum gages, *Standards, Ionization gages, Manometers, Reprints, *Calibration standards, Leak standards.

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The increasing reliance of American industry and science on vacuum technology has generated a continuing demand for improved vacuum measurement accuracy. The National Bureau of Standards has responded with a vacuum and leak standards program. The article describes the goals of the NBS program, the current state of vacuum standards and calibration services at NBS, and the operation of the U.S. voluntary standards program. Information is contained on the performance of vacuum instruments that might be used in an industrial vacuum calibration laboratory.

800,781
PB88-193859 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Recent Developments in the International Temperature Scale.

Final rept.,
R. J. Soulen. 1986, 4p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronic Engineering) Instrumentation and Measurement Conference, Boulder, CO., March 25-27, 1986, p288-291.

Keywords: *Temperature measurement, Resistance thermometers, Platinum, *Temperature scales.

An internationally approved temperature scale forms the basis for uniformity in temperature measurements throughout the world. Such a scale is in a continual process of evolution and improvement. Over the last five years there have been several developments in this field. Significant progress has been made in many areas including: (1) improved thermodynamic temperature measurements; (2) improved fixed points; and (3) improved interpolation by platinum resistance thermometry. The article will outline these advances and will indicate the status of international temperature scales presently in use.

800,782
PB88-194105 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
New Analysis of Interlaboratory Test Results.

Final rept.,
J. Mandel. 1985, 7p
Sponsored by American Society for Quality Control, Inc., Milwaukee, WI.
Pub. in Proceedings of the Annual Quality Congress Transactions (39th), Baltimore, MD., May 6-8, 1985, p360-366.

Keywords: Reproducibility, Precision, *Interlaboratory, Test methods.

An exposition by means of data taken from the literature, of the new methods of analysis of interlaboratory test results, developed by ASTM Comm. E11 on Statistical Methods.

800,783
PB88-194493 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Factors Affecting the Precision of Gas Operated Piston Gages at the Part Per Million Level.

Final rept.,
B. E. Welch, L. A. Guildner, and V. E. Bean. 1985, 4p
Pub. in Proceedings of the International Instrumentation Symposium (31st), San Diego, CA., May 6-9, 1985, p303-308.

Keywords: *Pressure gages, Measuring instruments, Pressure measurement, Precision, Metrology, *Piston gages.

The authors have been conducting a program with the goal of reducing random errors associated with gas operated piston gages to less than one ppm. Such precision requires design and operational considerations that are not always included in current normal practice. These factors include the design of the interface between the piston and weight hanger; surface finish treatment of the weighed parts; rotation method, rate, and decay time; magnetic effects; electrostatic forces from within and without the gage; and the differences between the gage and absolute mode. Examples illustrating the relative magnitude of these effects are presented.

800,784
PB88-225651 PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.

New Statistical Model for the Calibration of Force Sensors.

Technical note (Final),
C. P. Reeve. Jun 88, 49p NBS/TN-1246
Also available from Supt. of Docs. as SN003-003-02872-0.

Keywords: *Load cells, *Force, Statistical analysis, Confidence limits, Least squares method, Polynomials, *Calibration, Sensors.

The National Bureau of Standards has been calibrating force sensors for many years. The objective in these calibrations is to determine the functional relationship between the applied load and sensor response. In a typical calibration, several runs are made in which identical sequences of known loads are applied to the sensor. The sensor is rotated in the loading machine between runs. The previous method of analysis incorporated a quadratic polynomial model which was fit to the pooled data. The new method presented here fits separate polynomials to the mean data and between-run differences. The 'best' degrees of these polynomials are automatically determined by algorithms which incorporate statistical tests. As a result, error contributions from several sources are quantized. Methods for computing confidence intervals for the 'true' sensor response and for a new observation are given, and methods of inverse prediction (measurement of an unknown load) based on these intervals are illustrated.

800,785
PB88-225677 PC A02/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD.

Traceability of Laser Interferometric Length Measurements.

Technical note (Final),
H. P. Layer, and W. T. Estler. Jun 88, 8p NTB/TN-1248
Also available from Supt. of Docs.

Keywords: *Length, *Standards, Helium neon lasers, *Laser interferometry, Calibration, Traceability, US NBS.

The National Bureau of Standards maintains the standard of length in accordance with the definition of the meter, adopted by the General Conference of Weights and Measures (1983). The standard is used within NBS to form a consistent system of units which are used in NBS calibration services.

800,786
PB88-238514 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Modified Digital PID (Proportional-Integral-Derivative) Temperature Controller for Thermal Properties Measurements.

Final rept.,
J. G. Hust, B. J. Filla, and D. R. Smith. 1987, 6p
Pub. in Jnl. of Thermal Insulation 11, p102-107 Oct 87.

Keywords: *Temperature control, Thermodynamic properties, Controllers, Reprints, Computerized control systems.

A modified digital proportional-integral-derivative (PID) temperature controller for thermal properties measurements is described. Data are presented to illustrate the approach to equilibrium and the degree of stability at equilibrium. The controller is being used to control the heating elements of a high temperature guarded-hot-plate to within approximately 10 mK.

800,787
PB88-238522 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Thermocouple Device for Determination of Average Surface Temperature.

Final rept.,
J. G. Hust, and D. R. Smith. 1987, 6p
Pub. in Jnl. of Thermal Insulation 11, p96-101 Oct 87.

Keywords: *Temperature measuring instruments, *Thermocouples, Surface temperature, Reprints.

A thermocouple-based device for the measurement of average surface temperature is described. The device requires the measurement of only two emfs and yields the average temperature over the entire surface instrumented with the device. It consists of a single (normal) thermocouple and a thermopile-like element which

performs the averaging. A particular use of the device is described to illustrate its utility.

800,788
PB88-239496 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Effects of Abnormal Conditions on Accuracy of Orifice Measurement.

Final rept.,
S. E. McManus, J. A. Brennan, and C. F. Sindt. 1987, 5p
Contract GRI-5081-353-0422
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Proceedings of the International School of Hydrocarbon Measurement (62nd), Norman, OK., May 19-21, 1987, p196-200.

Keywords: *Flow measurement, *Orifice meters, Swirling, Accuracy, Errors.

The flowrate through an orifice meter can be calculated from the pressure temperature, differential pressure, and an empirical discharge coefficient. The discharge coefficients in AGA-3 were experimentally determined in 'normal' flow conditions, where there was no swirl, pulsations and the velocity profile was symmetric. In abnormal flow conditions, the discharge coefficient can be significantly different resulting in major errors in measurement. The paper will elaborate on the errors caused by two types of abnormal conditions--swirling and asymmetric flows--and discuss possible solutions.

800,789
PB88-246731 (Order as PB88-246707, PC A04)
National Bureau of Standards, Gaithersburg, MD.

International Comparisons of Pressure Standards: A Status Report.
C. R. Tilford. 4 Feb 88, 5p
Included in Jnl. of Research of the National Bureau of Standards, v93 n4 p545-549 1988.

Keywords: *Standards, Comparison, *Pressure standards, Interlaboratory comparisons.

In 1979, four working groups were established to organize comparisons between the pressure standards of the different national standards laboratories. These comparisons cover the range 0.000001 to 100,000,000 Pa. The report describes the progress of the different comparisons and summarizes the results where available.

800,790
PB88-246764 (Order as PB88-246707, PC A04)
National Bureau of Standards, Gaithersburg, MD.

Practical Uncertainty Limits to the Mass Determination of a Piston-Gage Weight.
R. S. Davis, and B. E. Welch. 25 Feb 88, 7p
Included in Jnl. of Research of the National Bureau of Standards, v93 n4 p565-571 1988.

Keywords: *Mass, *Weight measurement, *Piston gage weights, Balances, Uncertainty, Calibration.

The mass of a 590-g piston-gage weight was determined with a standard error of 0.057 mg (0.1 ppm). The sources of error are carefully examined. These include air-buoyancy corrections, physically adsorbed surface moisture, and air-convection within the weighing chamber. The authors conclude that significant improvement cannot be realized with the conventional weighing techniques available to most piston-gage users.

800,791
PB89-114060 PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.

Evaluation of a Standard Device for Calibrating Calorimeter Test Rooms.
W. J. Mulroy. Dec 86, 27p NBSIR-86/3465
Sponsored by Department of Energy, Washington, DC.

Keywords: *Calorimeters, *Test equipment, *Calibrating, *Standards, Air conditioning, Tests, Test facilities, Thermal measurements.

A device for calibrating calorimeter test rooms was evaluated by installing it on a test room calorimeter of small, known thermal transmittance which contained electric heaters capable of providing varying metered

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heat loads. The calibration device was evaluated only for its ability to measure heat load. The calorimeter instrumentation is described in detail. The calibration device is described primarily by reference.

800,792

PB89-114201 PC A07/MF A01
National Bureau of Standards, Gaithersburg, MD.
User's Guide for the Cone Calorimeter.
Special pub. (Final).
W. H. Twilley, and V. Babrauskas. Aug 88, 128p
NBS/SP-745
Also available from Supt. of Docs. as SN003-003-02889-4. Library of Congress catalog card no. 88-600556.

Keywords: *Calorimeters, Thermal measuring instruments, Fire hazards, Evaluation, Calibrating, Guidelines, Calorific value.

The report provides instructions for users of the Cone Calorimeter in installing, operating, maintaining, and repairing the instrument. It is intended for training new operators at NBS and at other laboratories. The troubleshooting and repair sections will be a useful reference section even for experienced operators, since remedies for a large number of potential instrument malfunctions are outlined.

800,793

PB89-118913 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. National Voluntary Lab. Accreditation Program.
DoD (Department of Defense) and NBS (National Bureau of Standards) Plan Laboratory Accreditation Experiment.
Final rept.,
H. W. Berger. 1987, 3p
Pub. in ASTM (American Society for Testing and Materials) Standardization News 15, n3 pt1 p44-46 Mar 87.

Keywords: *Calibrating, *Laboratories, Research projects, Feasibility, Cost analysis, Reprints, Accreditation, US DOD, National Institute for Standards and Technology.

A pilot project, planned by DoD and NBS, intended to determine the feasibility, costs, and benefits of laboratory accreditation for calibration laboratories, is described. The article briefly discusses the steps to be followed by DoD and the National Voluntary Laboratory Accreditation Program in carrying out the experiment and deciding on future actions.

800,794

PB89-119168 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Surface Texture Characterization by Angular Distributions of Scattered Light.
Final rept.,
D. E. Gilsinn, T. V. Vorburger, F. E. Scire, E. C. Teague, and M. J. Mclay. 1985, 10p
Contract NASA-L-4718-B
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v4B, p779-788 1985.

Keywords: *Optical measuring instruments, *Light scattering, *Surface roughness, Texture, Topography, Reprints, Laser applications, Profilometry.

Developing and testing optical scattering models for characterizing manufactured surfaces has led the National Bureau of Standards to develop instruments to measure the far field intensity distribution of scattered light, and to acquire surface microtopographic data using stylus profiling. A brief description of these instruments are given. Data acquired from both techniques were used to test several models for optical scattering. Results are given showing the correspondence between experimentally acquired optical data and forward scattering computations from manufactured surface profiles. A discussion is also given of the results obtained in trying to invert the intensity data and recover profile related parameters from given intensity data.

800,795

PB89-119762 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

National Voluntary Laboratory Accreditation Program.

Final rept.,
H. W. Berger. 1986, 1p
Pub. in American Laboratory 18, N11, 8 1986. See also NTN-840843.

Keywords: *Standards, *Laboratories, National government, Research projects, Tests, Accreditation.

The National Voluntary Laboratory Accreditation Program is briefly described in the report.

800,796

PB89-126858 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Thermal Diffusivity Measurement by the Transient Hot-Wire Technique: A Reappraisal.
Final rept.,
C. A. Nieto de Castro, B. Taxis, H. M. Roder, and W. A. Wakeham. 1988, 24p
Sponsored by Department of Industry, London (England), and Department of Energy, Washington, DC.
Pub. in International Jnl. of Thermophysics 9, n3 p293-316 May 88.

Keywords: *Thermal diffusivity, *Thermal measurements, Heat transfer, Thermal conductivity, Specific heat, Thermal measuring instruments, Precision, Errors, Accuracy, Reprints, *Transient hot-wire technique.

The theory of the transient hot-wire technique for thermal conductivity measurements is reassessed in the special context of thermal diffusivity measurements. A careful examination of the working equation and an error analysis are employed to identify the principal sources of error. Notwithstanding earlier claims to the contrary, the best precision that can be attained in thermal diffusivity measurements is of the order of \pm or $-$ 3%, while the accuracy is inevitably poorer. Experimental evidence is adduced from two different instruments that supports the analysis given here. Although the technique cannot yield values of the thermal diffusivity, k , as accurate as can be achieved by the use of the best possible individual values of λ , ρ , and $C(\text{sub } p)$ in the relation $k = \lambda/\rho C(\text{sub } p)$, the simplicity of the technique makes it attractive for many purposes. It is even possible to derive values of the isobaric heat capacity $C(\text{sub } p)$ for many fluids not available from other methods.

800,797

PB89-126924 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
National Bureau of Standards Primary High-Vacuum Standard.
Final rept.,
C. R. Tilford, S. Dittmann, and K. E. McCulloh. 1988, 7p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Vacuum Science and Technology A 6, n5 p2853-2859 Sep/Oct 88.

Keywords: *High vacuum, *Standards, Orifice flow, Vacuum gages, Design, Operations, Reprints, Ionization gages, Calibration, National Institute for Standards and Technology.

The theory, design, operating procedures, and estimated errors are discussed for an orifice-flow-type pressure standard currently in use at the National Bureau of Standards. This standard is used to define pressures between 10 to the 7th power and 0.1 Pa. Including the uncertainty of the flowmeter, the estimated total uncertainty varies from 2.6% at the highest pressures, to 1.4% at midrange, and 8.2% at the lowest pressures. Representative calibration results are presented for four different types of hot-cathode ionization gages.

800,798

PB89-128888 PC A07/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Temperature and Pressure Div.
NIST (National Institute of Standards and Technology) Measurement Services: Liquid-In-Glass Thermometer Calibration Service.
Special pub. (Final),
J. Wise. Sep 88, 132p NIST/SP-250/23
Also available from Supt. of Docs. as SN003-003-02891-6. Library of Congress catalog card no. 88-600580.

Keywords: *Calibrating, *Temperature measurement, Errors, Standards, Reliability, Temperature, *Liquid-in-glass thermometers, National Institute of Standards and Technology.

The document gives a description of the calibration of liquid-in-glass thermometers at the National Bureau of Standards. The calibration equipment and procedures used at NBS are discussed in detail. Calculations and stem-temperature corrections are shown and a discussion of the sources of error encountered in calibration and estimates of uncertainties is presented.

800,799

PB89-132104 PC A10/MF A01
National Bureau of Standards (NEL), Boulder, CO. Center for Electronics and Electrical Engineering.
Generation of Standard Electromagnetic Fields in a TEM (Transverse Electromagnetic) Cell.
Technical note, (Final),
M. Kanda, and R. D. Orr. Aug 88, 220p NBS/TN-1319
Also available from Supt. of Docs. as SN003-003-02898-3.

Keywords: *Radio frequencies, *Electromagnetic fields, *Calibrating, Antennas, Standards, Impedance, Variability, *TEM cells, Transverse electromagnetic cells, National Institute for Standards and Technology.

The paper documents the facilities and procedures used by the National Bureau of Standards to calibrate radio frequency electric field probes using a transverse electromagnetic (TEM) cell. The advantages, limitations, and physical characteristics of TEM cells are presented. Impedance, field uniformity, and mode structure, critical aspects of a cell as a standard field enclosure, are discussed. The paper concludes with sections on setup and measurement procedures for users, uncertainty in the standard field, and statistical control of the calibration system. Copies of key references are included to provide ready access to the details of topics summarized in the text.

800,800

PB89-132336 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Investigation of a User-Operated Mass Calibration Package.
R. M. Schoonover, and J. E. Taylor. Nov 88, 65p
NISTIR-88/3876

Keywords: Weight measurement, Temperature control, Mass, Data acquisition, Calibration, Measurement instruments, *Mass measurement, *Mass standards.

Reported are the results of two round-robin mass measurement programs. The first round-robin elucidated the many technical problems that required solutions before successful mass calibrations could be performed in all of the participant laboratories. The report details the technical innovations, i.e., thermal conditioning of the kilogram weights, balance servo control, automatic data acquisition, the measurement of some air density parameters, computer software, and presents the results. The results clearly indicate that in the future mass standards could be calibrated at locations remote from the NBS laboratory while maintaining the rigor necessary for certification.

800,801

PB89-133524 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Facilities of the National Institute of Standards and Technology, 1988.
Special pub. (Final).
Sep 88, 40p NIST/SP-732
Also available from Supt. of Docs. as SN003-003-02899-1. See also PB85-121200.

Keywords: *Test facilities, *Laboratories, Research, Cooperation, Utilization, Government furnished equipment, *US National Institute of Standards and Technology (US NIST), Research and development.

The brochure highlights a small number of the special NIST facilities which could be used to benefit research. It offers information on the capabilities of these facilities as well as their availability. Individuals or organizations who wish to use a NIST facility should contact the appropriate facility manager. Many of the research and testing facilities, some of which are unequaled

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anywhere in the world, are made available to other researchers for collaborative or independent work.

should use the latest computer technology and be upgradable to new technology as it becomes available.

ation effects, Electron energy, Positrons, High energy particles, Photons, Scattering, Reprints, Phantoms.

Manufacturing Processes & Materials Handling

800,802
PB88-177290 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Integrated Manufacturing Data Administration System (IMDAS)--An Overview.
Final rept.,
D. Libes, and E. Barkmeyer. 1988, 6p
Pub. in International Jnl. of Computer Integrated Manufacturing 1, n1 p44-49 1988.

Keywords: *Data administration, Reprints, *Automated manufacturing, CIM, IMDAS.

Automated manufacturing requires sharing of data among control, sensory and administrative processes. Since these processes are invariably distributed over many different computer systems, the authors claim that a distributed data system is necessary. Unlike most extant data systems, a manufacturing enterprise requires support for diverse computer systems, data systems and databases; real-time data access; and integration of new systems into a running complex. The paper briefly discusses these issues and describes a prototype implementation of a distributed data system that addresses them.

800,803
PB88-177332 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Choosing a Welding Procedure to Produce a Tensile-Long Tensile Specimen.
Final rept.,
T. A. Siewert, and G. E. Hicho. 1988, 3p
Sponsored by Nuclear Regulatory Commission, Washington, DC.
Pub. in Welding Jnl. 67, n2 p35-37 Feb 88.

Keywords: *Welding, *Nuclear reactors, *Steel, Pre-heating, Procedure development, Tensile testing, Welding.

Simulation of the stress fields in the pressure containment vessel of a nuclear reactor required the fabrication of large tensile specimens. The note describes the design requirements and final welding procedure used to fabricate these specimens. The specimens were constructed of A533B steel and were 10 m long, with a cross section of 1 m by 0.1 m.

800,804
PB88-236807 PC A03/MF A01
National Bureau of Standards, Boulder, CO.
Computerization of Welding Information: A Workshop Report, August 5-6, 1986.
Special pub. (Final).
T. A. Siewert, and J. E. Jones. Jun 88, 40p NBS/SP-742
Also available from Supt. of Docs. as SN003-003-02876-2. Library of Congress catalog card no. 88-600543. Prepared in cooperation with American Welding Inst., Louisville, TN. Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Welding, *Information systems, *Data processing, Data acquisition, Data storage, Data retrieval, Information retrieval, Systems engineering, Meetings.

Forty-two welding engineers, welding managers, and computer scientists gathered to discuss databases for welding information. Group discussions identified the most useful topics for welding databases; general welding procedures; properties of the weld, heat-affected zone, and base metals; procedure qualification records; and welding variables. Characteristics of the databases were discussed in terms of potential users, content, and sources of information. The participants concluded that a significant portion of the data needs can be met by existing information, but this information should be carefully screened and reviewed before inclusion in databases. Databases should be accessible to diverse group of potential users, and databases

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800,805
PB88-169529 PC A04/MF A01
National Bureau of Standards, Gaithersburg, MD.
NVLAP (National Voluntary Laboratory Accreditation Program) Directory of Accredited Laboratories, 1987-88.
H. W. Berger. Feb 88, 67p NBSIR-88/3718
See also PB86-158003.

Keywords: *Directories, *Laboratories, Test facilities, Accreditation.

The 1987-88 Directory of NVLAP Accredited Laboratories lists laboratories accredited under the procedures of the National Voluntary Laboratory Accreditation Program (NVLAP) as of January 1, 1988. Indexes cross reference the laboratories by name, NVLAP Lab Code Number, test method, accreditation program, and geographical location. The scope of accreditation of each laboratory, listing the test methods for which it is accredited, is provided along with a tabulation of test methods and the laboratories accredited for those test methods.

800,806
PB88-178520 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Acoustic Emission Sensors and Their Calibration.
Final rept.,
D. G. Eitzen, and F. R. Breckenridge. 1987, 13p
Pub. in Nondestructive Testing Handbook, v5 p122-134 1987.

Keywords: *Calibration, Sensors, Transducers, *Acoustic emission, Dynamic displacement.

The general nature and characteristics of sensors used in acoustic emission technology are described. Typical and special applications sensors are covered. Characteristic dimensions of sensors and sensor couplants are discussed. Primary calibration of AE sensors are also described and secondary calibration tools are outlined.

800,807
PB88-190012 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Deconvolution for Acoustic Emission.
Final rept.,
J. A. Simmons. 1986, 9p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v5A p727-735 1986.

Keywords: *Signal processing, Time series analysis, Reprints, *Acoustic emissions, *Deconvolution, Singular value decomposition.

A new technique is presented for deconvolution of time series (digitally recorded temporal waveforms) such as obtained in acoustic emission. The method, called cross-cut deconvolution, combines two different least squares methods--one completely new, the other a recently developed variant of singular valued decomposition--to produce a potentially robust technique for treating ill-conditioned problems. A simple example is given for deconvolution of a Gaussian kernel in the presence of varying amounts of noise by each least squares method.

800,808
PB89-124051 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Coupled Electron/Photon Monte Carlo Calculations of X-ray Scattering with Application to Industrial Radiography.
Final rept.,
G. Barnea, and C. E. Dick. 1987, 5p
Pub. in NDT (Non-Destructive Testing) International 20, n2 p111-115 Apr 87.

Keywords: *Radiography, *X rays, *Nondestructive testing, *Simulator routines, Computation, Monte Carlo method, Styrene resins, Polymers, Iron, Radi-

ation effects, Electron energy, Positrons, High energy particles, Photons, Scattering, Reprints, Phantoms.

Monte Carlo transport methods are used to simulate the scattering of x-rays in polystyrene and in iron phantoms. The calculations are made with monoenergetic x-ray sources in the energy region from 30 keV (100 keV for iron) to 20 MeV. The energy range includes the energy regions for diagnostic radiology (0.03-0.15 MeV), nuclear medicine (0.1-2.0 MeV) and industrial radiography (0.2-20 MeV). The phantom thickness for polystyrene was 5.3, 10, and 21 cm and for iron 0.7 and 1.4 cm. The present calculations include the effects of secondary electron/positron radiation which become quite important at high energies. As a function of the incident photon energy, the ratio of the scattered to the total radiation (scatter fraction) was found to have a characteristic 'N' shape. Increasing the atomic number of the scattering media has the effect of 'squeezing the N.'

800,809
PB89-132930 Not available NTIS
National Bureau of Standards (NML), Washington, DC. Office of Nondestructive Evaluation.
Introduction and Summary for Mechanical Relaxation of Residual Stresses.
Final rept.,
L. Mordfin. 1988, 122p
Pub. in Mechanical Relaxation of Residual Stresses, ASTM STP 993, 122p 1988.

Keywords: *Nondestructive tests, *Stress relaxation tests, *Residual stress, *Meetings, Mechanical tests, Fatigue strength at N cycles, Vibration tests, Reprints.

There are many reports in the published literature on mechanical treatments for reducing residual stresses. Examples of such treatments include fatigue cycling, mechanical vibration and cold working. In most of these reports the reduction of the residual stresses is not measured; rather, it is inferred from observed improvements in fatigue life, in corrosion resistance, or in other aspects of material durability. Accordingly, an international specialists' symposium was convened to obtain a better understanding of the mechanics of stress relief. The seven papers from the symposium are published in the book. They address all three of the principal mechanical treatments and are all based upon actual measurements of relaxation. Thus, it is likely that the volume will serve as a reliable foundation for those needing an introduction to the mechanical relaxation of residual stresses, as well as a current review for those seeking to research or otherwise advance the state of knowledge in this technologically important field.

Quality Control & Reliability

800,810
PB88-174222 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Statistical and Quality Control Standards In the U.S.
Final rept.,
M. G. Natrella. 1985, 12p
Pub. in Communications in Statistics-Theory and Methods 14, n11 p2753-2764 1985.

Keywords: *Quality control, *Standards, Quality assurance, Sampling, Inspection, Statistics, Reliability, Reprints, ANSI, ASTM, American National Standards Institute.

The U.S. standards system is a system of voluntary consensus standards in the private sector. There are more than 750 organizations in the U.S. that issue a total of 26,000 standards. Two very important standards organizations are ASTM and ANSI (American National Standards Institute). In particular, ASTM Committee E-11 on Statistical Methods and ANSI Committee Z-1 on Quality Assurance have developed statistical standards. Standards under the jurisdiction of these committees are listed. The most widely-used statistical standards are probably the standard tables for sampling inspection, which were developed by the U.S. military, and have been adopted, modified, or revised to appear in various standard systems, both military and civilian, national and international.

800,811
PB88-176615 Not available NTIS
 National Bureau of Standards, Gaithersburg, MD.
 Office of Product Standards Policy.
Laboratory Accreditation and the Procurement Community.
 Final rept.,
 P. S. Unger. 1985, 3p
 Pub. in ASTM (American Society for Testing and Materials) Standardization News, p39-41 May 85.

Keywords: Laboratories, Tests, Reprints, *Accreditation, International organizations, International coalition for procurement standards.

Reliable testing is important to the procurement community. Laboratory accreditation can identify competent testing laboratories. The purpose of the article is to discuss the use of laboratory accreditation by the procurement community, particularly highlighting the interest of the International Coalition for Procurement Standards.

800,812
PB88-176623 Not available NTIS
 National Bureau of Standards, Gaithersburg, MD.
 Office of Product Standards Policy.
Quality Statements in ASTM (American Society for Testing and Materials) Standard Specifications.
 Final rept.,
 P. S. Unger. 1985, 4p
 Pub. in ASTM (American Society for Testing and Materials) Standardization News, p44-47 Jul 85.

Keywords: *Quality control, *Quality assurance, *Specifications, *Standards, Measurement, Tests, Reprints, Calibration, ASTM.

The ASTM Committee E46 has published a guide and associated checklist for ASTM technical committees on the use of quality statements in specifications. The guide is intended to address the most important aspects of quality assurance in a specification. The paper discusses the contents of the guide and the use of the associated checklist.

General

800,813
PATENT-4 738 139 Not available NTIS
 National Bureau of Standards, Gaithersburg, MD.
Ultrasonic Real-Time Monitoring Device for Part Surface Topography and Tool Condition in situ.
 Patent,
 G. V. Blessing, and D. G. Eitzen. Filed 9 Jan 87, patented 19 Apr 88, 7p PB88-216031, PAT-APPL-7-001 905
 This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

Keywords: *Patents, *Ultrasonic tests, *Monitors, Wear, Tool life, PAT-CL-73/644, PAT-CL-73/105.

An ultrasound device sends and guides ultrasonic waves to a part surface through a fluid in laminar flow along a curved path, and then receives the reflected and/or scattered waves from that surface in the mode of a sensor. The received signal yields information about the part surface topography such as roughness, scratches, and dents. Since the device can operate in real-time in situ on moving, as well as on stationary parts, the received ultrasonic signal may be used to monitor tool wear during part fabrication, and even provide feedback information for machine control.

800,814
PATENT-4 765 754 Not available NTIS
 Department of Commerce, Washington, DC.
Inclined Contact Recirculating Roller Bearing.
 Patent,
 A. H. Slocum. Filed 12 May 87, patented 23 Aug 88, 10p PB88-250980, PAT-APPL-7-048 848
 Supersedes PB87-206942.
 This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Patents, *Roller bearings, Loads(Forces), Capacity, Design, Components, *Foreign technology, Recirculating roller bearings, PAT-CL-384-44.

A linear recirculating roller bearing is disclosed where the rollers travel in an inclined groove where the non-loading rolling groove is parallel to the loading roller groove. In the preferred embodiment four sets of rollers are provided which are able to bear loads from any direction. The angle of the rollers with respect to the bearing is dependent on the materials used and the overall dimensions of the system so that the bearing gap expands, due to temperature changes, at the same rate as the rollers.

800,815
PB88-177001 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Two Refrigerant Mixtures and the Hard Sphere Fluid.
 Final rept.,
 G. Morrison, and M. McLinden. 1985, 15p
 Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Transactions, v91 pt2B p929-943 1985.

Keywords: *Refrigerants, Mixtures, Equations of state, Mathematical models, Thermodynamic properties, Heat pumps, Reprints, Azeotropic mixtures, R13B1/R152a refrigerant, R12/R22 refrigerant.

This is a discussion of the use of the perturbed hard sphere equation of state to describe refrigerants and refrigerant mixtures. A brief review of mixture modeling is given. Two mixtures, R13B1/R152a, and R12/R22, are discussed as examples of the usefulness of the model.

800,816
PB88-177670 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Methods for Comparing the Performance of Pure and Mixed Refrigerants in the Vapour Compression Cycle.
 Final rept.,
 M. O. McLinden, and R. Radermacher. 1987, 8p
 Sponsored by Electric Power Research Inst., Palo Alto, CA.
 Pub. in Int. J. Refrig. 10, p318-325 Nov 87.

Keywords: *Vapor compression refrigeration cycle, *Refrigerants, Heat pumps, Mixtures, Fluids, Equations of state, Comparison, Capacity, Heating, Heat exchangers, Temperature, Heat transfer, Reprints, R22/R114 refrigerant, R22/P11 refrigerant.

Methods of comparing pure and mixed refrigerants are considered by computing the coefficient of performance and the heating capacity for an ideal vapor compression cycle for R22/R114 and R22/R11 mixtures. For comparisons based only on one characteristic condensation temperature and one evaporation temperature, the results depend entirely on how the characteristic temperatures are defined. A method specifying the heat transfer fluid temperatures and a total heat exchanger area per unit capacity is thought to offer a comparison applicable to both pure and mixed refrigerants. Using the method, the effects of compressor superheat, heat exchanger approach temperatures, and the match of refrigerant and heat transfer fluid temperatures are discussed.

800,817
PB89-132856 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Flowmeter Installation Effects.
 Final rept.,
 G. E. Mattingly, and T. T. Yeh. 1988, 13p
 Pub. in Proceedings of National Conference of Standards Laboratories, Washington, DC., August 14-18, 1988, p1-13.

Keywords: *Flowmeters, *Pipe flow, *Meetings, Performance evaluation, Calibrating, Speed indicators, Reprints.

A strategy is put forth through which flowmeter performance can be predicted for 'non-ideal' meter installation conditions. This strategy is based upon understanding the salient features of the pipeflows produced by such piping configurations as elbows, reducers, valves, etc. and also understanding how specific meters perform in these flows. Currently, national or international flowmetering standards give no guidance as to: (1) whether a selected meter's discharge coefficient or flow factor increases or decreases in non-ideal installation conditions, or (2) how much meter factor

'shift' might be produced relative to that for ideal installation conditions. The research results described herein include: (1) laser Doppler velocimetry measurements for the pipeflows produced by an elbows-out-of-plane configuration; (2) the quantification of these secondary flows in the downstream piping; and (3) the demonstration that our strategy works for a turbine-type flowmeter in these non-ideal installation conditions.

800,818
PB89-133516 PC A17/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
National Conference on Weights and Measures (73rd), 1988.
 Special pub. (Final),
 A. D. Tholen, C. S. Brickenkamp, and A. H. Turner.
 Sep 88, 400p NIST/SP-750
 Also available from Supt. of Docs. See also PB86-150232. Library of Congress catalog card no. 26-27766.

Keywords: *Metrology, *Meetings, Weight measurement, Metric system, Standards, Measurement, Specification, Tolerance.

The 73rd Annual Meeting of the National Conference on Weights and Measures was held at the Amway Grand Plaza Hotel in Grand Rapids, Michigan during the week of July 17 through 22, 1988. The theme of the meeting was the 'State Standards Program - 150th Anniversary'. A complete revision of the Liquid Measuring Device Code in NBS Handbook 44 was adopted. Policy and test procedures were adopted for accommodating moisture loss in prepackaged meat and poultry products from Federally-inspected plants. Revised policy was adopted on cash discount/credit card sales from single-price-computing motor fuel dispensers. Special meetings included those of the Task Force on Energy Allocation, Metrologists' Workshops, the Associate Membership Committee, the Retired Officials Committee, the Scale Manufacturers' Association, the Industry Committee on Packaging and Labeling, the state regional weights and measures associations, and National Association of State Departments of Agriculture Weights and Measures Division.

800,819
PB89-133565 PC A03/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
NIST (National Institute of Standards and Technology) Research Reports, October 1988.
 Special pub. (Final).
 Oct 88, 36p NIST/SP-743
 Also available from Supt. of Docs. as SN003-003-02905-0. Library of Congress catalog card no. 88-600590.

Keywords: *Metrology, *Research projects, Periodicals, *US National Institute of Standards and Technology(US NIST), Research and development.

Contents: Research update; NBS has new name, expanded role; Can we talk-speech recognition research at NIST; Pinpointing the origin of historical artifacts; Advanced materials: from laboratory to production line; Five NIST projects win R&D awards; Biotech center names top officials; High-resolution structure for chymosin solved; New technique automates sequencing of DNA; Role of inflammatory cells in DNA damage described; Laser cooling limit broken; Tracing the sources of industrial emissions; Helping industry find substitute CFC's; New publications; Conference calendar.

800,820
PB89-136501 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Progress in Force Measurement at NBS (National Bureau of Standards).
 Final rept.,
 R. A. Mitchell. 1984, 4p
 Pub. in Proceedings of the International Conference of the IMEKO Technical Committee TC-3 on Measurement of Force and Mass-Recent Advances in Weighing Technology and Force Measurement (10th), Kobe, Japan, September 11-14, 1984, p67-70.

Keywords: *Loads(Forces), Measurement, Comparison, Laboratories, Statistical analysis, Static load,

INDUSTRIAL & MECHANICAL ENGINEERING

General

Data processing, Environmental tests, Reprints, *Force measurement.

The paper reports recent developments in force measurement at NBS in seven areas: laboratory intercomparison; deadweight machine intercomparison; statistical analysis; voltage-ratio reference; temperature sensitivity testing; pressure sensitivity testing; and automated data logging. Examples of test results in some areas, interpretations of these results, and plans for continued work are presented.

LIBRARY & INFORMATION SCIENCES

Information Systems

800,821

PB88-217450

PC A12/MF A01

National Bureau of Standards (ICST), Gaithersburg, MD.

Computer Science and Technology: Guide to Auditing for Controls and Security: A System Development Life Cycle Approach.

Special pub. (Final).

Z. G. Ruthberg, B. T. Fisher-Wright, W. E. Perry, J. W. Lainhart, J. G. Cox, M. Gillen, and D. B. Hunt. Apr 88, 270p NBS/SP-500/153

Also available from Supt. of Docs. Library of Congress catalog card no. 88-600518. Prepared in cooperation with President's Council on Integrity and Efficiency, Washington, DC.

Keywords: *Information systems, *Auditing, Controls, Security, *Computer security, *System development life cycles.

The guide addresses auditing the system development life cycle (SDLC) process for an automated information system (AIS), to ensure that controls and security are designed and built into the system. It is directed toward mid-level ADP auditors having a minimum of two years experience in ADP auditing, but can also be used by security reviewers, quality assurance personnel, and as a training tool for less experienced ADP auditors. ADP managers and system developers will also find it useful guidance on security and control issues. It is designed to provide audit/review programs for each major phase of the SDLC process. It presents: (1) the model arrived at for describing the phases and functional roles in the entire AIS life cycle; (2) the accompanying flow of documents as the system progresses through the life cycle phases of Initiation, Definition, Design, Programming and Training, Evaluation and Acceptance, and Installation and Operation; (3) a security audit/review work priority scheme; and (4) audit/review programs for Initiation through Evaluation and Acceptance.

800,822

PB88-219944

PC A07/MF A01

National Bureau of Standards (ICST), Gaithersburg, MD. Information Systems Engineering Div.

Computer Science and Technology: Guide to Information Resource Dictionary System Applications: General Concepts and Strategic Systems Planning.

Special pub. (Final).

M. H. Law. Apr 88, 147p NBS/SP-500/152

Also available from Supt. of Docs. as SN003-003-02865-7. Library of Congress catalog card no. 88-600529.

Keywords: *Management information systems, *Information systems, *Data processing, *Standards, Systems management, Concepts, Guidelines, *Information management, *Information Resource Dictionary System, *Information processing, *Data dictionaries, *Federal information processing standards, Data structures, Data systems.

The guide describes the Information Resource Dictionary System (IRDS) and its applications, Information Resource Dictionaries (IRDs). Metadata to be stored in

an IRD is differentiated from data to be stored in a database. The role of the IRDS in Information Resource Management (IRM) and Data Administration is discussed. The development of the IRDS is described in terms of the evaluation of data processing toward larger, more complex systems that require greater control. With examples drawn from the first phase of the life cycle, the Strategic Systems Planning phase, the guide demonstrates how: (1) to develop example problem statements indicative of the information to be represented in an IRD; (2) to conceive of and define phase partitions and views through which to access information in an IRD; (3) to develop Entity-Relationship-Attribute models for each example problem statement; and (4) to use the IRDS command language in defining an IRD schema and in populating the IRD with metadata. Procedures for using the IRDS extensible schema capability are illustrated.

800,823

PB88-243159

PC A04/MF A01

National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.

ICST-NBS (Institute for Computer Sciences and Technology-National Bureau of Standards) Information Resource Dictionary System Command Language Prototype.

A. Goldfine, and T. Kirkendall. Aug 88, 56p NBSIR-88/3830

See also PB88-139100.

Keywords: Information systems, Prototypes, *Information management, *Data dictionaries, IRDS (Information Resource Dictionary System), Job control languages, Software tools, User manuals (Computer programs).

The publication is a report on the Information Resource Dictionary System (IRDS) Command Language prototype developed by the Institute for Computer Sciences and Technology of the National Bureau of Standards. It discusses the structure, source code, and operating environment of the Prototype, specifies the precise subset of the standard IRDS Command Language implemented, provides instructions for installing the Prototype software, and leads the reader through a typical user session.

800,824

PB89-133557

PC A06/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Computer Science and Technology: Data Administration: Management and Practice. Proceedings of the First DAMA (Data Administration Management Association) Symposium.

Special pub. (Final).

J. J. Newton, and F. E. Spielman. Oct 88, 123p NIST/SP-500/159

Also available from Supt. of Docs. as SN003-003-02901-7. Library of Congress catalog card no. 88-600586. Sponsored by Data Administration Management Association, Washington, DC. National Capital Region, Federal Data Management Users Group, Washington, DC, and Association for Federal Information Resources Management, Washington, DC.

Keywords: *Data, *Symposia, *Federal Information Resources Management, Information management, Data management, Data dictionaries, *Management information systems.

The publication constitutes the proceedings of a one-day symposium at the National Bureau of Standards on May 17, 1988. It was jointly sponsored by the National Capital Region of the Data Administration Management Association (NCR DAMA), the Federal Data Management Users Group (FEDMUG), and the Association for Federal Information Resources Management (AFFIRM). The symposium provided attendees with an opportunity to share the insights of leaders in the Data Administration field. Special emphasis was given to the factors which contribute to successful implementation of Data Administration management policies and practical methodologies.

800,825

PB89-136329

PC A09/MF A01

National Inst. of Standards and Technology (NCTL), Gaithersburg, MD.

Proceedings of the Federal Information Processing Standards (FIPS) Workshop on Information Resource Dictionary System (IRDS) Applications. A. Goldfine. Dec 88, 197p NISTIR-88/3896

Keywords: *Meetings, *Information systems, Data, Systems management, Dictionaries, Utilization, *Information Resource Dictionary System, IRDS.

The report consists of the user presentations at a workshop on applications of the Information Resource Dictionary System (IRDS), held at the National Bureau of Standards on March 24-25, 1988. Representatives of twenty Federal Government agencies discussed current and planned applications of the IRDS at their respective organizations.

Operations & Planning

800,826

PB89-124812

Not available NTIS

National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.

20 Years of Standards Information.

Final rept.,

S. J. Chumas. 1986, 4p

Pub. in Standards Engineering 38, n4 p81-83, 95 Jul/Aug 86.

Keywords: *Standards, *Information centers, Specifications, Regulations, Reprints, *National Center for Standards and Certification Information, Codes, Certification.

In 1965 the National Bureau of Standards collected a body of U.S. voluntary standards with the cooperation of industry. These standards formed the basis for a national index and the core of a national standards depository library. From its beginning, the Standards Information Service was dedicated to serve as the national focal point of information, but also responded to queries from all over the world. The re-named 'National Center for Standards and Certification Information' (NCSCI) in 1985 commemorated 20 years of furnishing standards information. The article reviews the history and changing role of NCSCI in supporting government, industry, and a world-wide public with standards and certification information. It concludes with a description of currently available service and information.

800,827

PB89-127542

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.

Survey Sample Design for Microfilm Inspection at the National Archives.

K. R. Eberhardt. Oct 88, 36p NISTIR-88/3889

Sponsored by National Archives and Records Administration, Washington, DC.

Keywords: *Surveys, *Microfilm, *Statistical analysis, *Statistical quality control, Sampling, Damage, Degradation, *National Archives.

The report describes the statistical design of a sample survey to monitor the condition of microfilm in a large collection maintained by the National Archives. The design criterion developed for the survey ensures that the number of rolls of film inspected will be large enough to achieve a pre-chosen probability of detecting a specified amount of damaged film that might exist in the population. Tables and formulas are given to satisfy the design criterion under a range of conditions. Other practical aspects of survey design are discussed including the sampling frame, stratification, sample selection procedure, pilot testing, and the use of replicated sampling.

Reference Materials

800,828

PB88-170022

PC A03/MF A01

National Bureau of Standards, Gaithersburg, MD.

NBS (National Bureau of Standards) Research Reports, December 1987.

Special pub. (Final).

Dec 87, 37p NBS/SP-735

Also available from Supt. of Docs. See also PB88-170030. Library of Congress catalog card no. 87-619882.

Keywords: *Research projects, Superconductivity, Electric contacts, Buildings, Collapse, Free radicals, Oxygen, Thermal insulation, Computer aided design, Computer aided manufacturing, Initial graphics exchange specification, IGES(Initial Graphics Exchange Specification), Parallel computers, Oxygen radicals.

Contents: Research update; Back to the basics; Will the Japanese beat the United States in superconductivity(question mark); Low-resistance contacts developed for high-temperature superconductivity; IGES--translating electronic tongues; Lifting system failure probable cause of fatal building collapse; Six NBS projects win 1987 I-R 100 awards; Matching processor and algorithms--the challenge of parallel computers; Process sensor measures internal temperatures in extruded aluminum: Life, death, and oxygen radicals; New technique for evaluating installation of home insulation; New publications; Conference calendar.

800,829

PB88-170030

PC A03/MF A01

National Bureau of Standards, Gaithersburg, MD.

NBS (National Bureau of Standards) Research Reports, August 1987.

Special pub. (Final).

Aug 87, 37p NBS/SP-733

Also available from Supt. of Docs. See also PB88-170022 and PB87-210258. Library of Congress catalog card no. 87-619861.

Keywords: *Research projects, *Superconductivity, Line width, Integrated circuits, Diesel engines, Thermocouples, Concretes, Technology, US NBS.

Contents:

Research update;
Riding a heat wave--researchers take another look at superconductivity;
President Reagan announces superconductivity initiative;
Life on the edge:
measuring linewidths;
Thin-film thermocouples designed for diesel engine research;
Concrete research at NBS--new ways to understand an old material;
Improved clinical lab tests:
goal of cooperative program;
Emerging technologies--the competitive edge of the future(question mark);
High-technology bugs are new tools for science and industry;
New publications;
Conference calendar.

800,830

PB88-240007

PC A17/MF A01

National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.

Publications of the National Bureau of Standards, 1987 Catalog.

Special pub. Rept. for Jan-Dec 87,

R. J. Pardee. Jun 88, 395p NBS/SP-305-SUPPL-19

Also available from Supt. of Docs. as SN003-003-02874-7. See also PB87-209961.

Keywords: *Catalogs(Publications), *Bibliographies, Indexes terms, Subject indexing, *National Bureau of Standards, US NBS.

Contents: About the National Bureau of Standards; Catalog structure and use; Availability and ordering information; NBS publications announcements; Indexes; Appendixes; Order forms; NBS technical publications program; NTIS subject categories.

800,831

PB88-246707

PC A04

National Bureau of Standards, Gaithersburg, MD.

Journal of Research of the National Bureau of Standards. Volume 93, Number 4, July-August 1988.

1988, 51p

Also available from Supt. of Docs. as SN703-027-00023-7. See also PB88-246715 through PB88-246764 and PB88-192331.

Keywords: *Research, Temperature control, Mass, Weight measurement, Enclosures, Standard cells, Voltage standards, Computer aided manufacturing, Computer vision, Pressure standards, Humidity measurement, Ammonium uranyl phosphates, Piston gage weights.

Contents:

An improvement in the reliability of standard cell enclosures;
The NBS vision system in the AMRF;
International comparisons of pressure standards -- a status report;
Condensation method for humidity measurement in the UMR cloud simulation chamber;
Precipitation of $\text{NH}_4\text{UO}_2\text{PO}_4 \cdot 3\text{H}_2\text{O}$ -- solubility and structural comparison with alkali uranyl(2+) phosphates;
Practical uncertainty limits to the mass determination of a piston-gage weight.

800,832

PB89-103790

PC A03/MF A01

National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.

Abstract and Index Collection: National Bureau of Standards Research Information Center.

Special pub. (Final),

D. Cunningham. Aug 88, 37p NBS/SP-751

Also available from Supt. of Docs. as SN003-003-02884-3. See also PB85-119501.

Keywords: *Abstracts, *Indexes(Documentation), Collection, Descriptions, *National Bureau of Standards.

An alphabetical arrangement of abstracts and indexes available at the National Bureau of Standards (NBS) Research Information Center (RIC) is listed by most current title of the publication. Other information includes description of the abstract or index, RIC holdings, principal sources, publisher or association, corresponding data base and the classification number. A general subject and former title/data base name index follow the main text of the report.

800,833

PB89-114755

PC A11/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD. Information Resources and Services Div.

NIST (National Institute of Standards and Technology) Serial Holdings 1988,

M. L. Kingdon. Sep 88, 247p NBSIR-88/3833

Supersedes PB83-132704.

Keywords: *Periodicals, *Bibliographies, Libraries, Collection, National government, Library collections, *National Institute of Standards and Technology.

The publication contains holdings information for approximately 5,000 titles held in the NBS Research Information Center, representing current and noncurrent journals, periodicals, annuals, memoirs, proceedings and transactions.

General

800,834

PB89-118947

Not available NTIS

National Bureau of Standards, Gaithersburg, MD. Office of Standards Code and Information.

Rationale Statements.

Final rept.,

D. R. Mackay. 1984, 1p

Pub. in ASTM (American Society for Testing and Materials) Standardization News 12, n4 p12 1984.

Keywords: *Standards, Documentation, Government procurement, Regulations, Reprints, *Rationale statements.

The editorial supports the need for the development and use of rationale statements for voluntary standards. It recommends that such statements be developed concurrently with standards. It suggests that the Federal policy of using voluntary standards in government procurement and regulatory programs will encourage the development of rationale statements.

MANUFACTURING TECHNOLOGY

Computer Aided Design (CAD)

800,835

PB88-192752

PC A19/MF A01

National Bureau of Standards (ICST), Gaithersburg, MD. Information Systems Engineering Div.

Collection of Technical Studies Completed for the Computer-Aided Acquisition and Logistic Support (CALS) Program - Fiscal Year 1987. Volume 1,

S. J. Kemmerer. Mar 88, 428p NBSIR-88/3726

See also Volume 2, PB88-192760. Sponsored by Department of Defense, Washington, DC.

Keywords: *Defense systems, *Logistic support, Computer applications, Standards, Data transmission, Systems engineering, Weapon systems, Standardization, *Computer aided design, *Computer aided manufacturing, Digital data, Computer-aided Acquisition and Logistic Support.

The overall objective of the Department of Defense Computer-aided Acquisition and Logistic Support (CALS) Program is to integrate the design, manufacturing, and logistic functions through the efficient application of computer technology. The National Bureau of Standards has been funded since Spring 1986 to recommend a suite of industry standards for system integration and digital data transfer, and to accelerate their implementation. A major FY87 thrust was the completion of initial documentation of the high-priority standards required in the CALS environment. The volume is one of four providing a collection of the final reports presented to the CALS Policy Office. Major areas contained within the volume include: text, data management, media, raster compression, and conformance testing strategy. The other three volumes contain the graphics and product data reports.

800,836

PB88-192760

PC A20/MF A01

National Bureau of Standards (ICST), Gaithersburg, MD. Information Systems Engineering Div.

Collection of Technical Studies Completed for the Computer-Aided Acquisition and Logistic Support (CALS) Program - Fiscal Year 1987. Volume 2,

S. J. Kemmerer. Mar 88, 475p NBSIR-88/3727

See also Volume 1, PB88-192752 and Volume 3, PB88-192778. Sponsored by Department of Defense, Washington, DC.

Keywords: *Defense systems, *Logistic support, Computer applications, Graphic methods, Standards, Data transmission, Systems engineering, Weapon systems, Standardization, *Computer aided design, *Computer aided manufacturing, Computer graphics, Digital data, Computer-aided Acquisition and Logistic Support.

The overall objective of the Department of Defense Computer-aided Acquisition and Logistic Support (CALS) Program is to integrate the design, manufacturing, and logistic functions through the efficient application of computer technology. The National Bureau of Standards has been funded since Spring 1986 to recommend a suite of industry standards for system integration and digital data transfer, and to accelerate their implementation. A major FY87 thrust was the completion of initial documentation of the high-priority standards required in the CALS environment. The second volume contains a collection of the final graphics reports presented to the CALS Policy Office. The other three volumes contain additional graphics reports as well as technical reports on text, product data, data management, raster compression, media, and conformance testing.

800,837

PB88-192778

PC A13/MF A01

National Bureau of Standards (ICST), Gaithersburg, MD. Information Systems Engineering Div.

MANUFACTURING TECHNOLOGY

Computer Aided Design (CAD)

CGM (Computer Graphics Metafile) Registration for CALS Requirements: A Technical Study Completed for the Computer-Aided Acquisition and Logistic Support (CALS) Program - Fiscal Year 1987, Volume 3.

S. J. Kemmerer. Mar 88, 298p NBSIR-88/3728
See also Volume 2, PB88-192760, and Volume 4, PB88-192786. Sponsored by Department of Defense, Washington, DC.

Keywords: *Defense systems, *Logistic support, Computer applications, Graphic methods, Standards, Data transmission, Systems engineering, Weapon systems, Standardization, *Computer aided design, *Computer aided manufacturing, Computer graphics, Digital data, Computer-aided Acquisition and Logistic Support.

The overall objective of the Department of Defense Computer-aided Acquisition and Logistic Support (CALS) Program is to integrate the design, manufacturing, and logistic functions through the efficient application of computer technology. The National Bureau of Standards has been funded since Spring 1986 to recommend a suite of industry standards for system integration and digital data transfer, and to accelerate their implementation. A major FY87 thrust was the completion of initial documentation of the high-priority standards required in the CALS environment. Volumes one, two and four provide a collection of the final reports presented to the CALS Policy Office. They cover such topics as text, product data, data management, raster compression, media, conformance testing, and graphics. Volume three specifically addresses Computer Graphics Metafile (CGM) registration requirements for CALS.

**800,888
PB88-192786** PC A08/MF A01

National Bureau of Standards (ICST), Gaithersburg, MD. Information Systems Engineering Div.
Collection of Technical Studies Completed for the Computer-Aided Acquisition and Logistic Support (CALS) Program - Fiscal Year 1987, Volume 4.
T. Wright. Mar 88, 156p NBSIR-88/3729
See also Volume 3, PB88-192778. Sponsored by Department of Defense, Washington, DC.

Keywords: *Defense systems, *Logistic support, Computer applications, Graphic methods, Standards, Data transmission, Systems engineering, Weapon systems, Standardization, *Computer aided design, *Computer aided manufacturing, Computer graphics, Initial Graphics Exchange Specification, Digital data, Computer-aided Acquisition and Logistic Support.

The overall objective of the Department of Defense Computer-aided Acquisition and Logistic Support (CALS) Program is to integrate the design, manufacturing, and logistic functions through the efficient application of computer technology. The National Bureau of Standards has been funded since Spring 1986 to recommend a suite of industry standards for system integration and digital data transfer, and to accelerate their implementation. A major FY87 thrust was the completion of initial documentation of the high-priority standards required in the CALS environment. The volume is one of four providing a collection of the final reports presented to the CALS Policy Office. Major topics contained within the product data volume include: the acceleration of testing methodology for IGES; the development of the IGES application subset concept; and the acceleration of PDES deliverables. The other three volumes include reports on text, data management, media, raster compression, graphics, and a conformance testing strategy.

**800,839
PB88-235452** PC A23/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD.
Initial Graphics Exchange Specification (IGES) Version 4.0.
Final rept. 1986-1988,
B. Smith, G. R. Rinaudot, K. A. Reed, and T. Wright.
Jun 88, 545p NBSIR-88/3813
See also PB86-199759.

Keywords: Computerized simulation, Electrical engineering, Drafting(Drawing), *Computer aided design, *Computer aided manufacturing, Computer graphics, Finite element analysis, User manuals(Computer programs).

The document contains a defined format for the representation and exchange of data found in today's commercially available CAD/CAM (Computer Aided

Design/Computer Aided Manufacturing) systems. Newly added capability includes constructive solid geometry and more complete support for finite element, electrical, and drafting applications.

**800,840
PB89-127120** Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.

Integration of Analysis and Databases for Engineering Decision Making.
Final rept.,
J. T. Fong. 1986, 14p
Pub. in Computers in Mechanical Engineering 5, n1 p42-55 Jul 86.

Keywords: *Engineering, Reliability, Nondestructive tests, Reprints, *Computer aided analysis, *Data bases, Software engineering.

Progress in computer-aided engineering analysis during the last three decades (1955-1985) is reviewed in comparison with the development of database technology in the information industry from mid-60's to the present. Failure to integrate engineering analysis with numerical database technology in the second decade (1965-1975) is cited as the contributing factor for the 'weak' conclusions in two widely publicized studies involving nuclear reactor safety (1975) and pipeline weld defect assessment (1976). Recent progress in improving engineers' ability to resolve complex issues by integrating analysis with database technology is illustrated in two case studies: (a) The assessment of an ultrasonic inspection procedure for flaw detection in thick-section steel welds; (b) The measurement of fatigue crack growth rates of two steels through an inter-laboratory test program. Opportunities for introducing more power to engineers through database-integrated software on both PCs and workstations in the next decade are discussed.

**800,841
PB89-127575** PC A03/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.
CAD Directed Automated Part Handling User's Reference Manual.
F. M. Proctor, and P. S. Tanguy. 15 Sep 88, 47p
NISTIR-88/3858

Keywords: Deburring, Cleaning, Algorithms, *Automated Manufacturing Research Facility, *Computer aided design, *Robotics, Workstations, Hardware, User manuals(Computer programs).

Techniques to reduce the amount of human support required for part handling in manufacturing are being researched at the Automated Manufacturing Research Facility of the National Bureau of Standards. In the Cleaning and Deburring Workstation, part geometry data is used to develop a graphics interface through which a user can specify how a part is to be gripped by a robot and how a part will be placed in a fixturing device. With a knowledge of the location of the part and fixturing device, a series of poses are computed and downloaded to a robot, which then executes the part handling motions. The manual provides information on using and modifying the hardware and software of the part handling system.

Computer Aided Manufacturing (CAM)

**800,842
PB88-164181** PC A04/MF A01

National Bureau of Standards, Gaithersburg, MD.
Process Plan Expression, Generation, and Enhancement for the Vertical Workstation Milling Machine in the Automated Manufacturing Research Facility at the National Bureau of Standards.
T. R. Kramer. 19 Nov 87, 65p NBSIR-87/3678
Prepared in cooperation with Catholic Univ. of America, Washington, DC.

Keywords: *Computer aided manufacturing, Automation, Machining, Milling(Machining), Production planning, LISP(Programming language), Computerized simulation, US NBS, AMRF(Automated Manufacturing Research Facility).

In the Vertical Workstation (VWS) of the NBS Automated Manufacturing Research Facility, metal parts are

machined automatically from a feature-based design. A simple two-and-a-half dimensional part may be designed and machined within an hour, allowing half the time for design input. With a design already in hand, the VWS software (which is written in LISP and runs on a Sun computer) will automatically prepare a process plan for a milling machine for making a part of the given design. The heart of the process plan is a list of machining operations to be carried out. The operations are selected by the system from among its repertoire of 21 possible operations. The process plan also includes a header and a list of tool requirements. Each step in the list of machining operations specifies a single operation, which is specified by giving the name of the operation and the values of several parameters.

**800,843
PB88-164256** PC A04/MF A01

National Bureau of Standards, Gaithersburg, MD.
Error Prevention and Detection in Data Preparation for the Vertical Workstation Milling Machine in the Automated Manufacturing Research Facility at the National Bureau of Standards.
T. R. Kramer, and W. T. Strayer. 19 Nov 87, 62p
NBSIR-87/3677
Prepared in cooperation with Catholic Univ. of America, Washington, DC.

Keywords: *Computer aided manufacturing, *Error detection codes, Automation, Machining, Milling(Machining), Production planning, LISP(Programming language), Computerized simulation, US NBS, AMRF(Automated Manufacturing Research Facility).

In the Vertical Workstation (VWS) of the NBS Automated Manufacturing Research Facility, metal parts are machined automatically from a feature-based design. In order to make VWS operation safe and accurate, extensive error prevention and detection (verification) procedures have been incorporated in the data preparation stages, particularly design and data execution. The software for these stages is about 700 pages of LISP code and runs on a Sun computer. About a quarter of the code is solely for error prevention. Automatic verification includes, design editor, dialogs, design enhancement, design verification (subdivided into parameter type checks, feature verification, and reference feature fit checking), process plan verification, workpiece verification, part model checking, and other items. Interactive verification includes design drawing, workpiece model drawing, and tool path drawing. The feature verifiers are prepared by a rule-based automatic programming subsystem.

**800,844
PB88-173984** Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
User-Level Shared Variables.
Final rept.,
D. Libes. 1985, 8p
Pub. in Proceedings of USENIX Association Summer Conference, Portland, OR., June 11-14, 1985, p317-324.

Keywords: Access, Programming languages, *Factory automation, *Message processing, *UNIX system, *Memory devices, *Computer aided manufacturing, Variables, User needs.

Implemented was a shared variable system for UNIX 4.2 that emulates a shared or common memory. Shared variables provide an alternate style of communications to message passing or pipes. The system is all user level code and requires no kernel modifications. It is accessible from a variety of languages. The authors are using the system in a real application - an automated factory.

**800,845
PB88-175443** Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Technology, Industry, Skills and Education.
Final rept.,
D. A. Swyt. 1986, 5p
Pub. in Technology Teacher 45, n7 p5-9 Apr 86.

Keywords: *Education, *Personnel, *Manpower, *Technical schools, Instructors, Feedback control, Reprints, *Industry, *Manufacturing automation control, *Skills, *Computer aided manufacturing, Feed-forward

control, Technology, Innovation, Technology innovation.

The paper is directed at technology educators and seeks to prompt discussion and coordinated action. From the author's point of view, technology, industry, people with skills and education interact as elements of a system, one which involves the technology in four ways: the creation of the technology; the assimilation of the technology into industry; the development of people skilled in the technology and the shaping of education directed at the technology. For the technology of automated manufacturing, examples are given of institutional mechanisms for feed-forward and feedback to allow that system to operate more effectively.

800,846
PB88-188057 PC A06/MF A01
National Bureau of Standards, Gaithersburg, MD.
VWS CADM User Interface of the Vertical Workstation of the Automated Manufacturing Research Facility at the National Bureau of Standards,
T. R. Kramer. 10 Mar 88, 120p NBSIR-88/3738

Keywords: *Computer aided manufacturing, Automation, Machining, Milling(Machining), Production planning, LISP(Programming language), Computerized simulation, *AMRF(Automated Manufacturing Research Facility).

The paper discusses the vws cadm user interface for the Vertical Workstation (VWS) of the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards. The descriptions pertain to the system in use during the summer of 1987. The vws cadm user interface provides a user-friendly means of using three of the major VWS modules and a variety of input and output capabilities of the VWS. There are two appendices to the paper. The first is a user manual for vws cadm and the second is a users manual for the VWS Part Design Editor. The paper is intended to be useful to people interested in concepts and technical details of the VWS, particularly AMRF personnel who are running the VWS or maintaining or improving the software for the VWS. The paper is intended to be useful also to other researchers in automated manufacturing. A knowledge of the computer language LISP is useful but not essential to reading the paper. Detailed documentation of the LISP functions that are involved with the systems described here is being prepared separately.

800,847
PB88-189279 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Interface Concepts for Plug-Compatible Production Management Systems.
Final rept.,
C. R. McLean. 1987, 12p
Pub. in Computers in Industry 9, n4 p307-318 Dec 87.

Keywords: Reprints, *Production management systems, *Interface standards, Factory automation, *Automated Manufacturing Research Facility.

Currently, the integration of production management systems that have been built by different vendors is either costly and time-consuming or virtually impossible. If factory integration costs are to be reduced, it is essential that these systems be made plug-compatible. The paper assesses current factors that lead to incompatibility between manufacturing systems built by different systems vendors. Taking these factors into consideration, an interface philosophy is suggested which could be used to guide future integration efforts. The application of the philosophy to key interfaces within the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards is discussed.

800,848
PB88-201629 PC A04/MF A01
National Bureau of Standards, Gaithersburg, MD.
AMPLE (Automated Manufacturing Programming Language Environment) Version 0.1 Prototype: The HWS (Horizontal Workstation) Implementation,
H. T. Bandy, V. E. Carew, and J. C. Boudreaux. 21 Apr 88, 74p NBSIR-88/3770

Keywords: *Automation, *Manufacturing, *Controllers, Interfaces, *Programming languages, Prototypes, Environments, Robots, Product development, Process control, *Computer aided manufacturing, *AMPLE system, *Software tools, Workstations, Automated Manufacturing Research Facility.

The Automated Manufacturing Programming Language Environment (AMPLE) system is being developed within the Center for Manufacturing Engineering of the National Bureau of Standards to provide a uniform programming language environment for the construction of control interfaces to industrial manufacturing processes; and to provide an integrated system of software tools for translating product design and process planning specifications into equipment-level control programs. Work on the AMPLE project has been surrounded by a larger and more comprehensive project which investigates the design of advanced automated manufacturing systems. The project, embodied in the Automated Manufacturing Research Facility (AMRF) of the National Bureau of Standards, has provided an invaluable source of empirical data and practical experience. In the report the modules of the implementation of the AMPLE Version 0.1, prototype for the Horizontal Workstation System (HWS) will be described.

800,849
PB88-211156 PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Architecture for Distributed Data Management in Computer Integrated Manufacturing,
E. Barkmeyer, M. Mitchell, K. P. Mikkilineni, S. Y. W. Su, and H. Lam. Jan 86, 57p NBSIR-86/3312
Prepared in cooperation with Florida Univ., Gainesville.

Keywords: *Manufacturing, Automation, *Computer aided manufacturing, *Distributed processing, *Data base management systems, Automated Manufacturing Research Facility, Integration, Factory automation.

The requirements of Computer Integrated Manufacturing (CIM) are examined using the Automated Manufacturing Research Facility (AMRF) project at the National Bureau of Standards as the basis for the study. The impact of a CIM environment on data management is described. An architecture for distributed data management is proposed which will support the heterogeneous computing environment and allow for autonomous operation of manufacturing cells.

800,850
PB88-217211 PC A04/MF A01
National Bureau of Standards, Gaithersburg, MD.
Vertical Workstation's Equipment Controllers of the Automated Manufacturing Research Facility at the National Bureau of Standards,
C. D. Lovett. 21 Apr 88, 67p NBSIR-88/3769

Keywords: *Computer aided manufacturing, *Factory automation, Machine tools, Robots, *Workstations, Communication protocols, Computer interfaces, Direct numerical control, Equipment controllers, Flexible automation, National Bureau of Standards.

The document describes how the central equipment controller (CEC) of the Vertical Workstation (VWS) operates as an interfacing controller between an upper-level controller, the workstation controller (WC), and three lower-level controllers and two data acquisition units. The CEC usually acts as a master controller when communicating with the three lower-level controllers and as a slave controller when communicating with the WC. The three lower-level controllers are computer-based. One of these is a robot controller, one is a machine tool controller and the third is a general purpose computer operating as a hydraulic controller. Each controller operates under a different communication protocol. The robot controller operates in a monitor command mode, the machine tool controller operates in a DNC mode (with NC program transfers) and the hydraulic controller operates in a command-driven program mode. The sensor inputs for achieving hardware handshaking are retrieved from the two data acquisition controllers.

800,851
PB88-219589 PC A03/MF A01
National Bureau of Standards, Gaithersburg, MD.
Cell Controller Operations Manual,
B. H. Thomas. 26 May 88, 23p NBSIR-88/3789

Keywords: *Controllers, *Manuals, *Computer aided manufacturing, Automated Manufacturing Research Facility, US NBS, User manuals, Personal computers.

The manual is designed to show a novice user how to startup, operate, and shutdown the cell controller. The manual assumes the operator knows the basic operation of a PC-clone computer. There are four major sections to this manual, basic operation of the cell

screen management system, startup of the cell, operation of the cell, and shutdown of the cell.

800,852
PB88-222856 PC A03/MF A01
Catholic Univ. of America, Washington, DC.
Graphics Subsystem of the Vertical Workstation of the Automated Manufacturing Research Facility at the National Bureau of Standards,
T. R. Kramer. 19 May 88, 35p NBSIR-88/3783
Grants NAMB-5-D0522, NAMB-7-H0716
Sponsored by National Bureau of Standards, Gaithersburg, MD.

Keywords: *Computer graphics, *Machining, *Computer aided manufacturing, Automated Manufacturing Research Facility, US NBS, Workstations.

Automated Manufacturing Research Facility, metal parts are machined automatically from a feature-based design. A simple two-and-a-half dimensional part may be designed and machined within an hour, allowing half the time for design input. The Graphics Subsystem of the VWS software is used for drawing part designs and workpieces by the VWS Part Design Editor and Data Execution module. Graphics capabilities are also available through a friendly user interface. The Graphics Subsystem is built on the 'SunCore' graphics package which has been interfaced with Franz Lisp. Designs and workpieces are drawn in three 2-dimensional views, as on a standard mechanical drawing. A variety of graphics capabilities and techniques are employed to carry out the functions required, including indexing, masking, picking, locating, scaling, translation, segmentation, restoring saved images, etc.

800,853
PB88-234216 PC A03/MF A01
National Bureau of Standards, Gaithersburg, MD.
Cleaning and Deburring Workstation Operations Manual,
K. Murphy, R. Norcross, P. Tanguy, and F. Proctor. Jun 88, 33p NBSIR-88/3804

Keywords: *Deburring, *Robots, *Cleaning, Smoothing, Machining, Instruction manuals, Real time operations, *Computer aided manufacturing, Workstations, Automated Manufacturing Research Facility, US NBS.

The manual provides instruction for the operation of the Cleaning and Deburring Workstation at the National Bureau of Standards' Automated Manufacturing Research Facility. The instruction sets are limited to the normal start-up and shut-down procedures of the workstation enabling an operator to run basic demonstrations and tests.

800,854
PB88-234232 PC A10/MF A01
National Bureau of Standards, Gaithersburg, MD.
AMRF (Automated Manufacturing Research Facility) Network Communications,
S. Rybczynski, E. J. Barkmeyer, E. K. Wallace, M. L. Strawbridge, D. E. Libes, and C. V. Young. Jun 88, 207p NBSIR-88/3816

Keywords: Topology, *Architecture(Computers), *Computer aided manufacturing, *Computer networks, Protocols, Network control, Interprocessor control, Real time operation, Multiprocessing, Automatic control, Automated Manufacturing Research Facility.

The document discusses the 1986 version of the factory data communications component of the National Bureau of Standards' Automated Manufacturing Research Facility. The underlying architecture, protocols, hardware, software and manual procedures are detailed.

800,855
PB88-234885 PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD.
Architecture and Principles of the Inspection Workstation,
H. T. Moncarz. 8 Jun 88, 55p NBSIR-88/3802

Keywords: *Product inspection, Quality control, Robots, Dimensional analysis, Surface roughness, Electronic control, Graphs(Charts), *Workstation, *Computer aided manufacturing, *Architecture(Computers), US NBS, Computer applications, Automated Manufacturing Research Facility.

MANUFACTURING TECHNOLOGY

Computer Aided Manufacturing (CAM)

The document describes the Inspection Workstation (IWS) of the National Bureau of Standards' Automated Manufacturing Research Facility (AMRF), in particular its software control architecture. The IWS uses a coordinate measuring machine for dimensional metrology, an optical roughness gage for surface finish inspection, and a robot for part handling within the workstation. Each of these three pieces of equipment is supervised by a separate controller, and a fourth controller coordinates these equipment controllers. The workstation coordination and all inspection procedures are specified entirely by data. In addition, the IWS is integrated into the AMRF control hierarchy, product data base, communications network, and material handling system. The software control architecture described herein allows this level of data-driven control and AMRF integration.

800,856
PB88-246723

(Order as PB88-246707, PC A04)
National Bureau of Standards, Gaithersburg, MD.
NBS (National Bureau of Standards) Vision System in the AMRF (Automated Manufacturing Research Facility),
M. Nashman, and K. J. Chaconas. 18 Mar 88, 6p
Included in Jnl. of Research of the National Bureau of Standards, v93 n4 p539-544 1988.

Keywords: Feedback control, Robots, Materials handling equipment, Real time operations, *Computer aided manufacturing, *Computer vision, Computerized control systems, Automated Manufacturing Research Facility, Image processing, Workstations.

The article describes the NBS Vision System developed by the Sensory Intelligence Group of the Robotics System Division which is used in the Automated Manufacturing Research Facility (AMRF). It discusses the objectives of the Vision System and its application in the factory environment. Since the Vision System is a multi-processor system, each process is described according to its position in the vision hierarchy as well as to its particular logical and computational functions. The interfaces between the individual processes of the Vision System and the interfaces between the Vision System and other AMRF systems are described. AMRF documentation packages describing the Horizontal Workstation, the Real-Time Control System and the Material Handling Workstation are available from the Center for Manufacturing Engineering.

800,857
PB89-107692 PC A03/MF A01
National Bureau of Standards, Gaithersburg, MD.
High Level Machine-Tool Control System,
D. Fishman. Aug 88, 44p NBSIR-88/3836

Keywords: *Machining, Real time operations, Automation, Interfaces, Tools, Computer systems hardware, *Automated Manufacturing Research Facility, *Workstations, *Control systems, *Computer aided manufacturing, Data bases, Robotics, Computer software, Factories.

The manual describes the High Level Machine-tool Controller (HLMC) in the Horizontal Workstation (HWS) of the Automated Manufacturing Research Facility (AMRF). Though the current implementation of the HLMC was designed for the HWS, there is sufficient modularity and flexibility in the system so that it may be reprogrammed to operate as an automated equipment controller in a workstation in another factory. The manual is divided into three sections. The overview describes the physical configuration of the HLMC in an automated workstation, the theoretical principles adhered to in integrating the component into an automated workstation, and the HLMC hardware. The architecture section is a more detailed description of all of the HLMC hardware and software interfaces. The implementation section gives the specific details of these interfaces, pointing out relevant hardware and software modules.

800,858
PB89-136303 PC A04/MF A01
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Factory Automation Systems Div.
Vertical Machining Workstation Systems,
J. S. Jun. 3 Nov 88, 74p NISTIR-88/3890
See also PB87-218368.

Keywords: *Manufacturing automation, Computer systems programs, *Vertical machining, Interface standards, Process planning.

The document presents an overview of the Vertical Machining Workstation (VWS) in the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards. It gives details of the workstation control flow. The prototype system demonstrates flexible computer integrated manufacturing for a family of prismatic parts. The workstation software components include: a feature-based design system for defining part geometries, an automatic process planning and numerical control code generation system, an automatic robot program generator, a state machine-based hierarchical control system which executes process plans, a diagnostic tools package, and mailbox communications software. The system is capable of running stand-alone, as a single station manufacturing system, or integrated under the AMRF cell controller.

800,859
PB89-136527 Not available NTIS
National Bureau of Standards (NBS), Gaithersburg, MD. Automated Production Technology Div.
AMPLE: A Programming Language Environment for Automated Manufacturing.
Final rept.,
J. C. Boudreaux. 1987, 18p
Pub. in The Role of Language in Problem Solving 2, p359-376 1987.

Keywords: *Manufacturing, *Computer system programs, *Programming languages, Automation, Reprints, Automated Manufacturing Programming Language Environment, AMPLE.

The paper describes the Automated Manufacturing Programming Language Environment (AMPLE) system, being developed within the Center for Manufacturing Engineering of the National Bureau of Standards. The development of the AMPLE system is being undertaken for two primary reasons: to provide a precise, conceptually transparent language for the construction of control interfaces to industrial manufacturing processes; and to address the technical and economic requirements of small-batch flexible manufacturing systems. The specific goals of the language design effort are to provide workstation programmers with a high-level programming environment to aid in the process of part manufacturing, and to provide an integrated system of software tools for translating process planning information into equipment-level programs.

Job Environment

800,860
PB88-180195 PC A08/MF A01
Texas Engineering Experiment Station, College Station.

Procedures for Quantitative Sensitivity and Performance Validation Studies of a Deterministic Fire Safety Model.

Doctoral thesis,
N. Khoudja. May 87, 154p NBS/GCR-88/544
Sponsored by National Bureau of Standards (NBS), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fire safety, *Buildings, Models, Reliability, Proving.

The increasing number of users of fire models demands their validation by a third party team to investigate the reliability of the models with respect to concerns of potential users. Due to insufficient documentation of the subject fire model, verification of it was limited and informal. However, quantitative and detailed procedures for sensitivity study and performance validation were applied. A deterministic model, predicting fire behavior in structure, was selected to illustrate partial model assessment procedures. The development and application of two generic methodologies for sensitivity analysis and performance validation are described. The subject fire model is FAST from which 16 input parameters were selected for sensitivity analysis study. Comparative Graphical Results are illustrated over simulation time for the input parameters.

800,861
PB89-129498 PC A04/MF A01
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Center for Radiation Research.

Optical Radiation Measurements: High Pressure Sodium Discharge Lamp Characterization for Use as Standards of Geometrically Total Luminous Flux.

Technical note (Final),
M. He, and R. J. Bruening. Aug 88, 53p NBS/TN-594/14
Also available from Supt. of Docs. Prepared in cooperation with Fudan Univ., Shanghai (China).

Keywords: *Optical measurement, Luminous intensity, Radiant flux density, Standards, Discharge lamps, Illuminating, *High pressure sodium lamps.

The stability of commercial 400W high pressure sodium lamps has been studied to allow the selection of lamps that produce a stable luminous flux on relighting. The properties of the lamps have been studied during the first minutes of starting, their output on relighting in place, and their output after 100's of hours burning. Lamps have been selected that repeat + or - 1% on relighting, and are expected to remain that stable over a life of about 4500 hours. The lamps have been calibrated for total luminous flux by sphere comparison, with an uncertainty of + or - 4.6%. These lamps will be used as working standards, and gonometric measurements will be made to reduce the uncertainty.

800,862
PB89-123228 PC A03/MF A01
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Center for Fire Research.
Hazard I-Results of a User Evaluation on the Prototype Software,
R. W. Bukowski. Nov 88, 33p NISTIR-88/3878

Keywords: *Fire hazards, *Mathematical models, *Analyzing, Fire safety, Fire prevention, Evaluation, Human factors engineering, Combustion, *Computer software, Data bases, Computer graphics.

After five years of development, the prototype of a personal computer-based fire hazard analysis method was distributed to 93 volunteers representing all aspects of the fire community. These persons agreed to evaluate the software and documentation, and attempt to apply it to a problem of their own choosing. Written comments were to be returned, which would be used to establish priorities for future changes, and where possible, be incorporated into the general release version of the product. Written responses were received from 47 participants, most of which dealt with suggestions for improvements to the user interface (rather than any technical shortcomings). Based on the responses received, it has been concluded that: the software will be of substantial, broad benefit; with the identified improvements, the user interface is comparable to commercial software in ease of use; the data base is particularly useful, but needs to contain many more entries; and priority enhancements need to be made in the areas of combustion modeling and pictorial graphics.

Joining

800,863
PB89-123327 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Welding in the Soviet Union: A Closer View.
Final rept.,
T. A. Siwert, and H. G. Ziegenfuss. 1987, 8p
Pub. in Welding Jnl., p27-34 Nov 87.

Keywords: *Welding, *Union of Soviet Socialist Republics, Reprints, *Technology transfer, American Welding Society.

In May 1987, from the 17th to the 28th, a group of five U.S. welding experts visited welding facilities in seven cities in the Soviet Union. The objective was to develop contacts in the Soviet welding industry and to investigate possible technical and commercial interactions. This is a summary of the trip, describing the plants and institutes visited.

Manufacturing, Planning, Processing & Control

800,864
PB88-176524 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg,
 MD. Metallurgy Div.

Needs for Process Control in Advanced Processing of Materials.

Final rept.,
 R. Mehrabian, and H. N. G. Wadley. 1985, 20p
 Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v4B p839-858 1985.

Keywords: *Process control, Continuous casting, Non-destructive tests, Solidification, Neutron scattering, Welding, Rapid quenching (Metallurgy), Small angle scattering, Sensors.

Advanced materials processing is currently limited by the inability to properly monitor and control the processes. 'Intelligent' computer-aided process control systems are needed for advanced processing of materials to ensure reproducibility and reliability of sophisticated microstructures. Components of such systems are predictive process models relating process variables to microstructure/properties, sensors (both direct and indirect) to characterize microstructure/physical properties during processing, and 'intelligent' feedback control systems based on artificial intelligence, expert systems and control theory. Rapid solidification, continuous casting, welding, and ceramic consolidation processing are used as prototypes.

800,865
PB88-192141 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Factory Automation Systems Div.
Control of an Automated Machining Workstation.
 Final rept.,
 J. S. Jun, and C. R. McLean. 1988, 5p
 Pub. in IEEE (Institute of Electrical and Electronics Engineers) Control Systems Magazine 8, n1 p26-30 Feb 88.

Keywords: Reprints, *Automated Manufacturing Research Facility, *Manufacturing automation research, Factory control architectures, Vertical machining, Process planning, Interface standards.

The software architecture of the vertical machining workstation in the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards is presented. The prototype system demonstrates flexible computer-integrated manufacturing for a family of prismatic parts. The workstation software components include: a feature-based design system for defining part geometries, an automatic process planning and numerical control code generation system, an automatic robot program generator, a state machine-based hierarchical control system that executes process plans, a diagnostic tools package, and mailbox communications software. The system is capable of running stand-alone, as a single-station manufacturing system, or integrated under the AMRF cell controller.

800,866
PB88-205315 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg,
 MD. Metallurgy Div.
Needs for Process Control in Advanced Processing of Materials.
 Final rept.,
 R. Mehrabian, and H. N. G. Wadley. 1985, 8p
 See also PB88-176524.
 Pub. in Jnl. of Metals 37, n2 p51-58 Feb 85.

Keywords: *Process control, Continuous casting, Non-destructive tests, Solidification, Neutron scattering, Welding, Reprints, Rapid quenching (Metallurgy), Small angle scattering, Sensors.

Advanced materials processing is currently limited by the authors inability to properly monitor and control the processes. 'Intelligent' computer-aided process control systems are needed for advanced processing of materials to ensure reproducibility and reliability of sophisticated microstructures. Components of such systems are predictive process models relating process variables to microstructure/properties, sensors (both direct and indirect) to characterize microstructure/physical properties during processing, and 'intelligent' feedback control systems based on artificial intelligence, expert systems and control theory. Rapid solidification, continuous casting, welding, and ceramic consolidation processing are used as prototypes.

800,867
PB88-230529 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Automated Production Technology Div.

Precision Ultrasonic Thickness Measurements of Thin Steel Disks.

Final rept.,
 G. V. Blessing, D. G. Eitzen, J. F. Henning, A. V. Clark, and R. E. Schramm. 1988, 10p
 Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v7B p1563-1572 1988.

Keywords: *Dimensional measurement, *Thickness, *Acoustic measurement, Ultrasonic radiation, Acoustic velocity, Machining, Disk(Shapes), Reprints, Thin plates.

The accurate in-situ measurement of part dimensions during fabrication is of much interest to the manufacturing industry, especially for untended manufacturing. The goal of the work is to apply non-contacting ultrasonic techniques to the precise thickness measurement, during machining, of metal parts of rotation having a nominal wall thickness of 1.5 mm. The desired accuracy is ± 0.0025 mm at all points on the approximately 200 mm diameter steel shells, where part access is restricted to one side at a time for the measurement. In a feasibility study, dimensional information using eddy current techniques was overwhelmed by conductivity variations in the 304-stainless steel samples (1). The approach here is to precisely measure ultrasonic echo transit times, and calculate part dimensions, knowing the material sound speed. To that end, feasibility results on flat disk specimens possessing a wide range of grain sizes representative of the shell's variable metallurgy are reported here. Comparisons were made of the ultrasonic dimensional values with precision interferometer measurements.

Quality Control & Reliability

800,868
PB88-145560 MF E04
 National Bureau of Standards, Gaithersburg, MD.
KWIC (Key-Word-In-Context) Index of U.S. Voluntary Engineering Standards.
 Mar 88, 2486p
 Supersedes PB87-133377.
 Microfilm copies only (Ten sheets of 48X reduction).
 A supplementary document, U.S. Organizations Represented in the Collection of Voluntary Standards, accompanies this index.

Keywords: *Standards, Indexes(Documentation), Subject index terms, Specifications, Tests, United States, Engineering standards, Product standards.

The index contains the permuted titles of more than 28,000 standards, specifications, test methods, and recommended practices published by approximately 400 U.S. standards-developing organizations. Each title can be found under all the significant key words which it contains. These key words are arranged alphabetically down the center of each page together with their surrounding context. The date of publication or last revision, the standard number and an acronym designating the standards-issuing organization appear as part of each entry. A supplementary document, U.S. Organizations Represented in the Collection of Voluntary Standards, Accompanies the index.

800,869
PB88-169750 (Order as PB88-169727, PC A05)
 National Bureau of Standards, Gaithersburg, MD.
Grid Plate Calibration at the National Bureau of Standards.
 T. D. Doiron. 1988, 11p
 Included in Jnl. of Research of the National Bureau of Standards, v93 n1 p41-51 Jan-Feb 88.

Keywords: Metrology, Automation, *Grid plates, *Calibration, Computer vision, Two dimensional, US NBS.

Grid plates are calibrated by a completely automated high precision measuring machine which uses a computer vision system to detect and locate the grid marks. The system routinely calibrates plates of up to 600 x 600 millimeters with accuracies of 0.5 micrometers. Descriptions of the system components, level of

performance and tests of the absolute accuracy of the calibrations are presented.

800,870
PB88-174172 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg,
 MD. Metallurgy Div.

Acoustic Dimensional Resonance Tomography: Some Examples in One-Dimensional Systems.

Final rept.,
 L. R. Testardi, S. J. Norton, and T. Hsieh. 1986, 4p
 Pub. in Jnl. of Applied Physics 59, n1 p55-58 1986.

Keywords: *Tomography, *Nondestructive tests, Acoustic impedance, Resonant frequency, Aluminum alloys, Reprints.

A spatial map of the variation of acoustic impedance within a material structure can be made using only its resonance frequencies. The authors demonstrate this for a one-dimensional rod having a diameter, D, which varies along its length, 1, by determining D(1) from fundamental and overtone resonances. They also show how the technique can locate material/processing inhomogeneities in the elastic modulus and/or density on a scale of several parts per thousand for 'stock' rods of an aluminum alloy using nondestructive and noncontact testing.

800,871
PB88-174180 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg,
 MD. Metallurgy Div.

Reconstruction of One-Dimensional Inhomogeneities in Elastic Modulus and Density Using Acoustic Dimensional Resonances.

Final rept.,
 S. J. Norton, and L. R. Testardi. 1986, 10p
 Pub. in Jnl. of Acoust. Soc. Am. 79, n4 p932-941 Apr 86.

Keywords: *Acoustic resonance, *Nondestructive tests, Heterogeneity, Resonant frequency, Reprints.

A method is described for quantitatively reconstructing a spatial inhomogeneity in density and elastic modulus along a one-dimensional structure from measurements of its resonant frequencies (fundamental and overtones). The shifts in the resonant frequencies of the structure due to a material inhomogeneity (computed relative to the frequencies of the homogeneous state) are shown to be related to the coefficients in a Fourier expansion of the inhomogeneity. If a number of successive resonant frequencies are excited and measured, the unknown inhomogeneity may then be reconstructed by Fourier summation.

800,872
PB88-205117 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg,
 MD. Metallurgy Div.

Reconstruction of One-Dimensional Inhomogeneities in Elastic Modulus and Density from Measurements of Acoustic Resonances.

Final rept.,
 S. J. Norton, L. R. Testardi, and T. Hsieh. 1985, 10p
 See also PB88-174180.
 Pub. in Proceedings of International Symposium on Acoustical Imaging (14th), The Hague, Netherlands, April 22-25, 1985, p123-132.

Keywords: *Acoustic resonance, *Nondestructive tests, Heterogeneity, Resonant frequency.

A method is described for quantitatively reconstructing a spatial inhomogeneity in density and elastic modulus along a one-dimensional rod from measurements of its resonant frequencies (fundamental and overtones). The authors show that the shifts in the resonant frequencies of the rod due to a material inhomogeneity (computed relative to the frequencies of a homogeneous rod or fiducial state) bear a simple relation to the coefficients in a Fourier expansion of the inhomogeneity which is exact to first order in the material perturbation. The authors also show that a change in the boundary condition at one end of the rod is required to recover both the even- and odd-order Fourier coefficients of the unknown inhomogeneity. Reconstructions are presented using measured resonant frequencies of thin brass and aluminum rods with localized and distributed inhomogeneities induced artificially. The resulting images of the density and modulus inhomogeneities agree well with theoretical expectation.

MANUFACTURING TECHNOLOGY

Quality Control & Reliability

800,873

PB88-217229

PC A03/MF A01

National Bureau of Standards, Gaithersburg, MD.
Inventory of Equipment in the Inspection Workstation,
J. H. Zimmerman. 5 May 88, 15p NBSIR-88/3775

Keywords: *Production engineering, *Data acquisition, *Quality control, Inventories, Equipment, Controllers, Robots, *Inspection workstations, Surface roughness, Coordinate measuring machine.

The document is a comprehensive inventory guide to electronic and mechanical equipment and instruments used by the Inspection Workstation (IWS) in the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards. The IWS is a prototype facility with four computer systems and six essential components. The computer systems of the IWS include the Main Workstation Controller (WSC), the Inspection Robot Controller (IRC), the Coordinate Measuring Machine Controller (CMC), and the Surface Roughness Instrument Controller (SRIC). The principal commercial mechanical and electronic equipment and instruments include the horizontal arm coordinate measuring machine (CMM), the automatic dial indicator (ADI), the inspection robot, the mechanical (NBS-designed) robot gripper, the electronic safety fence, and the optical surface roughness instrument (SRI).

800,874

PB88-217245

PC A03/MF A01

National Bureau of Standards, Gaithersburg, MD.
Implementation of the Execution Control System of the Inspection Workstation,
H. T. Moncarz. 19 May 88, 31p NBSIR-88/3787

Keywords: *Production engineering, *Data acquisition, *Quality control, Assembly, Automation, Electronic equipment, Implementation, *Inspection workstations, Printed wiring assemblies, *Execution control system.

The document describes the implementation of the execution control system (ECS) of the Inspection Workstation. ECS is a program that runs on each controller computer and incorporates the design principles of the AMRF. The program loads up and executes the state machine modules required to make the computer on which it is running operate as a specific controller -- be it the robot, coordinate measuring machine, surface roughness instrument, or workstation controller. The ECS program sits on top of the computer's operating system. In addition to loading and running the proper modules, it provides communications between modules, network communications to other controllers, and a common interface to data.

800,875

PB88-217930

Not available NTIS

National Bureau of Standards (NBS), Gaithersburg, MD. Automated Production Technology Div.
Ultrasonic NDE for Surface Roughness.

Final rept.,

D. G. Eitzen, and G. V. Blessing. 1988, 4p

Pub in MRS Bulletin 13, n4 p49-52 Apr 88.

Keywords: *Surface roughness, *Ultrasonic tests, *Tools, *Wear, Nondestructive tests, Cutting tools, Automation, Detectors, Reprints, Sensors.

An ultrasonic sensor system has been developed which provides an in-process monitor of surface finish. The amplitude of the back reflected ultrasound correlates well with average surface roughness and is in good agreement with a Kirchhoff model for coherent wave scattering when the ultrasonic wavelengths are much greater than the surface roughness. Stream coupling was shown to work well using the coolant/lubricant fluids employed with cutting tools in CNC metal cutting even at high surface speeds (up to 5 m/sec). The possibility of using air coupling in some applications was established. The capability of using highly focused ultrasound to create a profilometer was demonstrated, but interpretation is made more difficult by effects such as finite ultrasonic beam width. The technique offers an approach for tool condition monitoring for dull or damaged tools, and therefore, a tool management strategy that could be very useful in unintended manufacturing. The technique may also provide an approach for monitoring other material processes such as the rolling of sheet metal.

800,876

PB88-222849

PC A03/MF A01

National Bureau of Standards, Gaithersburg, MD.

Recommended Technical Specifications for Procurement of Commercially Available Systems for the Inspection Workstation,

J. H. Zimmerman. May 88, 30p NBSIR-88/3779

Keywords: *Specifications, Surface roughness, Controllers, Robots, Procurement, *Inspection workstations, Computer aided manufacturing, Automated Manufacturing Research Facility, Workstations, Computerized control systems, Coordinating measuring machines, US NBS.

The document furnishes the technical specifications of the Inspection Workstation (IWS) in the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards. The IWS is a prototype automated inspection facility. The principal commercial mechanical and electronic equipment and instruments of the IWS include the horizontal arm coordinate measuring machine (CMM), the inspection robot (IRC), and the optical surface roughness instrument (SRI). The computer systems of the IWS include the Main Workstation Controller (WSC), the Inspection Robot Controller (IRC), the Coordinate Measuring Machine Controller (CMC), and the Surface Roughness Instrument Controller (SRIC). Other equipment and instruments include the automatic dial indicator (ADI) and the electronic safety fence.

800,877

PB88-232889

PC A04/MF A01

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Internal Discontinuity Sensor Needs for Steel: Report of a Workshop. Held at Gaithersburg, Maryland, July 16, 1986,

H. N. G. Wadley, and C. D. Rogers. Jun 88, 71p

NBSIR-88/3731

Sponsored by American Iron and Steel Inst., Washington, DC.

Keywords: *Sensor characteristics, *Steel casting, *Cracking(Fracturing), Defects, Fractures(Materials), Steel making, Quality control, Process control, Real time operations, Meetings.

Operators, engineers and researchers representing American Iron and Steel Institute member companies met with scientists and engineers from federal laboratories, universities and sensor vendor companies to determine the formation mechanisms of internal discontinuities in continuous cast steel, identify sensors for their detection and control strategies for their elimination. The development of online sensors to detect inclusions and cracks within the caster was determined to be urgently needed for real time quality control. Outputs from such sensors could be used to detect inert gas shroud cracking (the most common source of the most deleterious inclusions) and cracking problems and facilitate feedback control. Of all the potential sensor methodologies addressed, ultrasonic approaches similar to those developed for porosity work and also related to those under development for internal temperature/solidification interface measurement were considered the most promising. Collaborative programs need to be instituted to prove the ultrasonic approach and develop data for the design of a prototype sensor.

800,878

PB89-107650

PC A03/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Implementation of the Surface Roughness Instrument (SRI) Controller,

H. T. Moncarz, and T. V. Vorburger. Sep 88, 50p

NISTIR-88/3794

Keywords: *Surface roughness, *Inspection, Robots, Optical equipment, *Workstation, US NBS, Automated Manufacturing Research Facility.

The document describes the theory and implementation of the Surface Roughness Instrument Controller (SRIC) program. The controller is part of the Inspection Workstation (IWS) in the Automated Manufacturing Research Facility (AMRF) in the Center for Manufacturing Engineering at the National Bureau of Standards. The SRIC supervises the surface roughness inspection of a part. The inspection is data driven. The SRIC controls two pieces of equipment -- the surface roughness instrument (SRI) and the automatic dial indicator (ADI). The SRI monitors surface roughness by measuring the angular distribution of light scattered from the surface of a part. It does its job in coordination with the IWS robot. Using the SRI optical signals as

sensory input, the robot properly aligns the part in front of the SRI so that a valid optical scattering reading is obtained. (The ADI is used to help the robot position the part in front of the SRI for its initial reading.) The SRIC uses the optical data obtained to compute an rms value for roughness and a roughness average.

800,879

PB89-107676

PC A03/MF A01

National Bureau of Standards, Gaithersburg, MD.

Implementation of the Inspection Workstation Controller,

S. A. Osella. 13 Jul 88, 34p NBSIR-88/3819

Keywords: *Inspection, Interfaces, Scheduling, Implementation, *Automated Manufacturing Research Facility, *Control systems, *Work stations, Inspection workstation, Robots, Hierarchical control.

The document describes the implementation of the Inspection Workstation Controller (WSC). The WSC is a program which is designed to supervise the equipment controllers of the Inspection Workstation. The WSC uses a data driven, hierarchical task decomposition control strategy and incorporates the University of Virginia model for system initialization, restart, and shutdown. The WSC is comprised of a number of Finite State Machine Modules each responsible for a particular aspect of the control process.

800,880

PB89-126635

PC A04/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Implementation of the Coordinate Measuring Machine Controller,

H. T. Moncarz, T. H. Hopp, and P. Lezark. 13 Oct 88, 53p NISTIR-88/3874

Keywords: *Product inspection, *Dimensional measurement, Control equipment, Quality assurance, *Workstations, *National Institute for Standards and Technology, *Automated Manufacturing Research Facility, Inspection Workstation.

The document describes the theory and implementation of the Coordinate Measuring Machine Controller (CMC) program. This controller is part of the Inspection Workstation (IWS) in the Automated Manufacturing Research Facility (AMRF) at the National Institute of Standards and Technology. The CMC supervises the coordinate measuring machine to perform a dimensional inspection of a part. This inspection is completely data-driven. The data consist of geometry, topology and tolerance information for the part as well as specific inspection data such as probe point sequencing information and probe characteristics.

800,881

PB89-129134

PC A11/MF A01

National Bureau of Standards, Gaithersburg, MD.

Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices as Adopted by the 73rd National Conference on Weights and Measures, 1988 (1989 Edition),

H. V. Oppermann. Sep 88, 232p NBS/HS-44/1989

Also available from Supt. of Docs. as SN003-003-02888-6. Supersedes PB88-123765.

Keywords: *Measuring instruments, *Weight indicators, *Handbooks, Specifications, Tolerances(Mechanics), Requirements, Standards, Volume unit meters, Moisture.

Handbook 44 was first published in 1949, having been preceded by similar handbooks of various designations and in several forms beginning in 1918. The 1989 edition was developed by the Committee on Specifications and Tolerances of the National Conference on Weights and Measures, with the assistance of the Office of Weights and Measures of the National Bureau of Standards. It includes amendments adopted by the 73rd annual meeting of the National Conference on Weights and Measures in 1988. Handbook 44 is published in its entirety each year following the annual meeting of the National Conference on Weights and Measures. Handbook 44 also includes the complete revised Liquid-Measuring Devices Code and Taximeter Code.

800,882

PB89-129563

PC A09/MF A01

National Bureau of Standards, Gaithersburg, MD.

Uniform Laws and Regulations as Adopted by the National Conference on Weights and Measures (73rd), 1988.

Final rept.,
C. S. Brickenkamp. Sep 88, 193p NBS/HB-130/1989
Also available from Supt. of Docs. Supersedes PB88-123724.

Keywords: *Weight measurement, *Regulations, Standardization, Handbooks, Units of measurement, Packaging, Labels, Commodities, Sales, Prices, Consumer affairs, Automotive fuels, *Weights and measures, Open dating, Unit pricing.

The handbook, revised annually, compiles the Uniform Laws and Regulations developed by the Committee on Laws and Regulations of the National Conference on Weights and Measures (NCWM). The compilation itself was approved by the NCWM in 1979, and the edition includes amendments adopted by the Conference at its annual meeting in 1988. The NCWM recommends adoption and promulgation by the states of these uniform laws and regulations as updated in the handbook.

800,883
PB89-131254 PC A04
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 93, Number 5, September-October 1988.

Oct 88, 70p
Also available from Supt. of Docs. as SN703-027-00024-5. See also PB89-131262 through PB89-131288 and PB88-246707.

Keywords: *Metrology, *Thermistors, *Crystal growth, Monochromatic radiation, Diffraction, Synchrotron radiation, Convection, Velocity, Solubility, Chemical equilibrium, Tables(Data), Graphs(Charts), *Octacalcium phosphate, *Imaging techniques, Absorbed dose.

The Journal of Research of the National Bureau of Standards features advances in measurement methodology and analyses consistent with the NBS responsibility as the nation's measurement science laboratory. It includes reports on instrumentation for making accurate and precise measurements in fields of physical science and engineering, as well as the mathematical models of phenomena which enable the predictive determination of information in regions where measurements may be absent. In the issues are articles on: Diffraction imaging (Topography) with monochromatic synchrotron radiation; Convective velocity effects on a thermistor in water; Octacalcium phosphate solubility product from 4 to 37 C.

800,884
PB89-131270
(Order as PB89-131254, PC A04)
National Bureau of Standards, Gaithersburg, MD.

Convective Velocity Effects on a Thermistor in Water,
S.R. Domen. 14 Apr 88, 10p
Included in Jnl. of Research of the National Bureau of Standards, v93 n5 p603-612 Apr88.

Keywords: *Meteorology, *Thermistors, *Convection, *Velocity, Calorimeters, Graphs(Charts), Water, Convective heat transfer, Absorbed dose.

Electrical powers from 5 to 150 micro W were dissipated in a thermistor, causing it to rise to equilibrium temperatures above the stagnant surrounding water. Natural convection was then simulated by forced convection of water flowing up or down at known rates from 1.3 to 17 mm/min. The disturbances of the equilibrium temperatures were measured, and are presented as effects of equivalent absorbed dose and absorbed dose rates, positive and 'negative'.

800,885
PB89-132732 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Low-Accelerating-Voltage SEM (Scanning Electron Microscope) Magnification Standard Prototype.

Final rept.,
M. T. Postek, and R. C. Tiberio. 1988, 2p
Pub. in Proceedings of Annual Meeting of the Electron Microscopy Society of America (46th), Milwaukee, WI., August 7-12, 1988, p198-199.

Keywords: *Electron microscopy, *Magnification, *Standards, Semiconducting devices, Wafers, Silicon,

Prototypes, Design criteria, *Scanning electron microscopes, Electron beam lithography, Standard reference materials, Calibration standards.

NBS has recently begun a cooperative effort with the National Nanofabrication Facility at Cornell University to fabricate a new SEM magnification standard by electron beam lithography. The design of the standard is such that integrated structures in both the X and Y directions can be used to calibrate the scans of the SEM. Structures with a nominal pitch of 0.20 micrometers permit calibration from the lowest magnification range to in excess of 200,000x. Prototype samples, designed both to test manufacturability and the ability to solve the present problems with SRM 484, were fabricated on semiconductor wafers. The etched silicon structures demonstrate good contrast throughout the accelerating voltage range. The presentation will outline the design criteria and the work being done to produce and certify this as a SEM magnification standard.

800,886
PB89-134209 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
Electrochemical Technique for Rapidly Evaluating Protective Coatings on Metals.
Technical note (Final),
C. Lin, and T. Nguyen. Oct 88, 25p NIST/TN-1253
Also available from Supt. of Docs. as SN003-003-02910-6.

Keywords: *Organic coatings, *Corrosion prevention, *Tests, Metal coatings, Alkyd resins, Acrylic resins, Steels, Contamination, Performance evaluation, Polarization, Electrochemistry.

A new electrochemical technique based on multicyclic scanning potentials applied to a specimen in an electrolyte was developed and evaluated as a method for rapidly evaluating the corrosion protection performance of organic coatings on metal. Opaque alkyd and clear acrylic coated steel samples prepared at different thicknesses, curing conditions, defect inclusions, and contamination concentrations were used for the evaluation. The applied potentials were between -1.8 and +1.8 V, and the electrolyte was a 3% NaCl solution. Preliminary results indicate that the technique is useful for evaluating the corrosion protection properties of organic coatings on steel. The technique appears to offer a number of advantages: fast and in situ measurements, good reproducibility, high sensitivity, and minimal damage to the coating.

800,887
PB89-136535 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Back-to-Back Accelerometer as a High Frequency Vibration Standard.

Final rept.,
B. F. Payne. 1985, 5p
Pub. in Proceedings of the International Instrumentation Symposium (31st), San Diego, CA., May 6-9, 1985, p239-243.

Keywords: *Accelerometers, *Vibration, *Standards, Calibrating, High frequencies, Measurement, Reprints.

Back-to-back (BTB) accelerometers are widely used as laboratory standards and have been of increasing interest and research in recent years. Previous research has focussed on correct calibration methods and mass-loading characteristics of the BTB accelerometer. The paper gives experimental calibration data for a BTB accelerometer, for both absolute and comparison calibration methods from 10 Hz to 15 kHz. The calibration results of a typical single-ended accelerometer calibrated on a BTB standard are presented in the paper assuming first a comparison and then an absolute calibration of the BTB standard. The data presented here, together with its subsequent analysis, suggest that the BTB is an accurate and stable calibration standard and that the absolute and comparison measurement methods developed for the type of standard give good agreement over the entire calibration range.

800,888
PB89-137640 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

NBS (National Bureau of Standards) Research on the Effects of Pipe Roughness and Flow Conditioners on the Orifice Discharge Coefficient.

Final rept.,
C. F. Sindt, J. A. Brennan, and S. E. McFaddin. 1987, 3p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Proceedings of Operating Section, American Gas Association--Distribution/Transmission Conference, Las Vegas, NV., May 4-6, 1987, p502-504.

Keywords: *Flowmeters, Surface roughness, Flow control, Pipes, Orifice meters, Reprints, *Orifice discharge coefficient.

The National Bureau of Standards at Boulder, Colorado, has been investigating the effects on the orifice discharge coefficient of the location of flow conditioners and of the surface roughness of orifice meter tubes. The investigation has been conducted using a 4-inch meter. The flow conditioners investigated were a tube bundle and a Sprenkle and were located at seven pipe diameters upstream of the orifice plate. Surface roughness from 0.7 to 6.9 micrometers (30 to 270 microinch) were used in the tube upstream of the orifice plate. The impact of the flow conditioner was to decrease the orifice discharge coefficient. At surface roughness above 3.8 micrometers (150 microinch) the effect of the surface roughness was an increase in the orifice discharge coefficient, especially at high beta ratios.

800,889
PB89-137665 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Coping with Non-Existent National Standards: An NBS (National Bureau of Standards) Perspective.
Final rept.,
B. C. Belanger. 1985, 4p
Pub. in Proceedings of Measurement Science Conference, Santa Clara, CA., January 17-18, 1985, p89-92.

Keywords: *Calibrating, *Standards, Measurement, Laboratories, Reprints, National standards.

The act establishing the US National Bureau of Standards (NBS) lists as a principal function to undertake 'The custody, maintenance, and development of the national standards of measurement and the provision of means and methods for making measurements consistent with those standards...' For many common measurements, calibration laboratories can achieve traceability to national standards by utilizing measurement services provided by NBS. High-level calibration laboratories typically provide calibrations for lower level laboratories in a hierarchical fashion so that measurements at the working level can ultimately be related to national standards. Measurement inconsistencies may develop where national measurement standards do not exist or where measurement services are unavailable from NBS. The paper outlines from NBS' perspective the nature of the resulting problems and discusses how they may be resolved.

Robotics/Robots

800,890
PATENT-4 765 668 Not available NTIS
Department of Commerce, Washington, DC.
Robot End Effector.

Patent,
A. H. Slocum, and P. A. Jurgens. Filed 26 Jun 87, patented 23 Aug 88, 10p PB88-251004, PAT-APPL-7-067 400
See also PB86-166402.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Patents, *Robots, *Manipulators, Holders, *End effectors.

A double-handed, robot end effector or gripper which can be used for moving and positioning machine parts. The gripper is elongate and symmetric about its longitudinal axis, having a first and a second set of hands extending in each of the two transverse directions. Each hand has a removable finger and is positioned about an accurately repeatable midpoint. The hands

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are mounted on and are moved about the longitudinal plane by a ball screw which is rotated by either an electric motor or an air driven motor through gears located at one end.

800,891
PB88-169438 PC A09/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD.
Real-Time Control System of the Horizontal Workstation Robot,
A. J. Wavering, and J. C. Fiala. 16 Dec 87, 184p
NBSIR-88/3692

Keywords: *Robots, Real time operations, *Computerized control systems, *Control systems, Automated Manufacturing Research Facility.

The manual describes the real-time control system used to control the robot in the Horizontal Workstation of the Automated Manufacturing Research Facility.

800,892
PB88-175278 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Model-Based Strategies for High-Level Robot Vision.
Final rept.,
M. O. Shneider, R. Lumia, and E. W. Kent. 1986, 14p
Pub. in Computer Vision, Graphics, and Image Processing 33, n3 p293-306 Mar 86.

Keywords: Matching, Prediction, Real time, Recognition, Reprints, *Feature based representation, *Robot vision.

The paper describes the higher levels of a sensory system for a robot manipulator. The sensory system constructs and maintains a representation of the world in a form suitable for fast responses to questions posed by other robot subsystems. This is achieved by separating the sensing processes from the descriptive processes, allowing questions to be answered without having to wait for sensors to respond. Four groups of processes are described. Predictive processes (world modellers) are needed to set up initial expectations about the world and to generate predictions about sensor responses. Processes are also needed to analyze the sensory input. The authors make use of the predictions in analyzing the world. A third essential function is matching, which compares the sensed data with the expectations, and provides errors that help to serve the models to the world.

800,893
PB88-175294 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Representation Solids for a Real-Time Robot Sensory System.
Final rept.,
R. Lumia. 1986, 10p
Pub. in Proceedings of International IFIP/IFAC Conference on Software for Discrete Manufacturing (6th), Paris, France, June 11-13, 1985, p393-402 1986.

Keywords: *Automated manufacturing, *Knowledge bases, Part representation, Real time processing.

The goal of the sensory system is to supply sufficient information to the robot control system, which actually moves the robot, to accomplish a desired task. The sensory system constantly updates a model of the 3-D workspace to reflect reality. The model is decoupled from the sensory processing so that the control system can be given responses without having to wait for sensory processing. A real-time world model is presented which incorporates both CAD descriptions of known parts and information about each specific object in the workspace. In order to enhance its speed, the 3-D model supports several representations. The world model predicts the 3-D features for the objects in the workspace of the robot which are used by other modules in the sensory system.

800,894
PB88-176649 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
General Procedure to Evaluate Robot Positioning Errors. Part 1 - Theory.
Final rept.,
R. N. Vaishnav, and E. B. Magrab. 1987, 16p
Pub. in International Jnl. of Robotics Research 6, n1 p59-74 1987.

Keywords: *Robots, *Manipulation, *Positioning, Linear regression, Errors, Evaluation, Reprints.

A new, explicit, and complete formulation that describes the geometric errors due to both origin translation and misalignments of axes in the positioning of an open-loop robot manipulator has been presented. The formulation does not use the usual Denavit-Hartenberg approach. The results clearly display the role of each quantity involved and allow easy physical interpretation of each error term.

800,895
PB88-189188 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Using Chebyshev Polynomials for Interpreting Structured Light Images.
Final rept.,
M. O. Shneider, W. S. Rutkowski, and T. H. Hong. 1985, 4p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) International Conference on Robotics and Automation, St. Louis, MO., March 25-28, 1985, p17-20.

Keywords: Real time operations, Approximation, *Robot vision, Chebyshev polynomials.

A method is described of representing curved or line-like segments in images using Chebyshev polynomials. The advantages of the approximations include fast computation, minimum error over the sampling intervals, and the reduction of the data to a concise description consisting of a few coefficients. An implementation is discussed that uses images obtained from a structured-light ranging system.

800,896
PB88-189618 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Extensible Ball Bar for Evaluation of Robots Positioning Performance.
Final rept.,
N. Vira, and K. Lau. 1987, 16p
Pub. in Jnl. of Robotic Systems 4, n6 p799-814 1987.

Keywords: Accuracy, Measurement, Performance evaluation, Repeatability, Reprints, *Robot testing.

The paper describes the development of a one dimensional extensible ball bar designed to measure the positioning accuracy and repeatability of industrial robots. The ball bar has a linear travel of 5 cm (2 in) that is monitored by a built-in electronic transducer having a resolution of 2.5 micrometers (0.0001 in). At both ends of the bar are two precision steel spheres, one of which is attached to an universal joint mounted on a robot's wrist. The other steel ball is magnetically attached to a socket which is firmly located within the work zone of the robot. During the measuring process the robot wrist is programmed to move in an arc whose radius is the nominal length of the bar. The variation of the length of the bar is recorded from the linear transducer and used to obtain a one-dimensional measurement of the positioning performance of the robot. Linear displacement and sag tests indicate that the ball bar has an accuracy of 32 micrometers (0.0013 in) and a repeatability of 18 micrometers (0.0007 in). Test procedures to evaluate a robot's performance are also presented.

800,897
PB88-192489 PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Coordinated Joint Motion for an Industrial Robot,
J. L. Michaloski. Mar 88, 33p NBSIR-88/3735

Keywords: *Robots, *Motion, Kinematics, Mechanics (Physics), Automatic control equipment, Equations of motion, Real time operations, Computer aided manufacturing, Robotics, Manipulators.

The tools to build a coordinated joint motion controller for a robot are presented. A general overview of how robot poses are translated into joint angles with the use of coordinate frames is included to provide the necessary background to understand how a robot achieves motion. Within the coordinated joint level, a forward kinematic solution that provides intermediate Cartesian point and a geometric backward solution are described for the Cincinnati Milicron T3 industrial robot. Given the kinematics, a coordinated joint algorithm to scale the velocities and acceleration of joint motion was also described. Finally, problems with the coordinated joint level were reviewed.

800,898

PB88-194261 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.

Hierarchically Controlled, Sensory Interactive Robot in the Automated Manufacturing Research Facility.

Final rept.,
H. G. McCain. 1985, 9p
Pub. in Proceedings of International Conference on Robotics and Automation, St. Louis, MO., March 25-28, 1985, p931-939.

Keywords: *Robots, *Machining, Factory automation, Cleaning, Deburring, Inspection, *Computer aided manufacturing, *Manufacturing automation control, *Automated Manufacturing Research Facility, Factory automation, Workstations.

The National Bureau of Standards, Center for Manufacturing Engineering is implementing an experimental factory called the Automated Manufacturing Research Facility (AMRF). The AMRF will operate as a small batch machine shop and is currently configured with three machining workstations, a cleaning and deburring workstation and an inspection workstation. Each of these workstations will employ robotic material handling including machine loading and unloading. At present each workstation is at a different stage of completion. The Horizontal Workstation which contains a horizontal spindle numerically controlled machine tool and one material handling robot has been completely integrated and is now operational. The robot in the workstation is a Cincinnati Milacron T3 (hydraulic) which has been greatly enhanced to meet the requirements of the AMRF. The robot has been equipped with a hierarchical robot control system, a 3-D vision system, a watchdog safety system and an instrumented, servo controlled gripper, all of which were developed at the National Bureau of Standards. Each of these systems are described individually together with a description of the enhanced capabilities of the robot with these systems operating as an integrated package.

800,899

PB88-194279 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.

Development of a Cleaning and Deburring Workstation for the AMRF (Automated Manufacturing Research Facility).

Final rept.,
H. G. McCain, K. N. Murphy, and R. D. Kilmer. 1985, 19p
Pub. in Tech. Pap. Soc. Manuf., p8-5--8-24 1985.

Keywords: *Robots, *Machining, Cleaning, Deburring, Design, Philosophy, Reprints, *Workstations, *Computer aided manufacturing, *Manufacturing automation control, *Automated manufacturing Research Facility, *Factory automation.

The Center for Manufacturing Engineering is currently developing a facility for conducting research on automated manufacturing. The facility, called the Automated Manufacturing Research Facility, or AMRF, is concentrating on the manufacture of machined metal parts in small batches. One aspect of the overall manufacturing process is the deburring and cleaning of parts. These problems are being addressed in the AMRF in the Cleaning and Deburring Workstation. The paper presents the design philosophy of the workstation and the approaches to be used in developing an automated cleaning and deburring system. The near-term solution of utilizing conventional mass deburring and buff-brush-polish techniques is described. Future approaches involving the use of industrial robots to automatically deburr parts is also discussed, including research that is necessary to develop this technology. The research includes force sensing of robots, control of two robots working together cooperatively and visual inspection of parts all of which are currently under study at NBS.

800,900

PB88-194410 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.

Architecture for Intelligent Manufacturing Control.
Final rept.,
C. R. McLean. 1985, 7p
Pub. in Proceedings of International Computers in Engineering Conference and Exhibit, Boston, MA., August 4-8, 1985, v2 p391-397.

Keywords: Production management, Interfaces, Standards, *Manufacturing automation control, *Computer aided manufacturing, *Factory automation, *Automated Manufacturing Research Facility, *Hierarchical control, Modules.

A small batch manufacturing system testbed, currently under construction at the National Bureau of Standards (NBS), is designed to support research in factory automation standards. One of the expressed goals of the NBS Automated Manufacturing Research Facility (AMRF) project is the specification of the interfaces which must exist between component systems of automated factories. Many new component systems will have to be developed before automated factories possess a level of intelligence equal to that found in conventional manufacturing. Undoubtedly, factories will eventually be constructed from modules that are offered as 'plug compatible' products by different systems vendors. These vendors will need a standard factory model or system architecture for planning and implementing external interfaces to their proprietary systems. The paper describes aspects of the AMRF architecture and proposes mechanisms for the implementation of intelligent manufacturing control modules.

800,901
PB88-215637 PC A04/MF A01
National Bureau of Standards, Gaithersburg, MD.
Implementation of the Inspection Robot Controller.
H. T. Moncarz, and B. Borchardt. 21 Apr 88, 57p
NBSIR-88/3772
See also PB88-169438.

Keywords: *Robots, *Controllers, Surface roughness, Inspection, Computerized control systems, Inspection Robot Controller Program, IRC program, Automated Manufacturing Research Facility, Workstations.

The document describes the theory and implementation of the Inspection Robot Controller (IRC) program. The controller is part of the Inspection Workstation (IWS) in the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards. The IRC is commanded by the Inspection Workstation Controller, and in turn, the IRC supervises the IWS robot and is also the supervisor to the Surface Roughness Instrument Controller. The configuration of the workstation as well as important points throughout it are specified to the IRC as data.

800,902
PB88-218193 PC A05/MF A01
National Bureau of Standards, Gaithersburg, MD.
Operations Manual for the Inspection Workstation (of the AMRF).
H. T. Moncarz, S. A. Osella, B. Borchardt, and R. Veale. 21 Apr 88, 79p NBSIR-88/3766

Keywords: *Robots, *Controllers, Surface roughness, Inspection, Surface finishing, Computerized control systems, Automated Manufacturing Research Facility, IRC program, Workstations, Inspection Robot Controller Program.

The document describes the operation of the Inspection Workstation (IWS) of the Automated Manufacturing Research Facility (AMRF). The IWS uses a coordinate measuring machine for dimensional metrology, an optical roughness gage for surface finish inspection, and a robot for part handling within the workstation. Each of these three pieces of equipment is supervised by a separate controller, and a fourth controller (the workstation controller) coordinates these equipment controllers. The IWS can receive its commands either from the AMRF Cell Controller or from the keyboard of the IWS workstation controller. The detailed instructions for starting the IWS and maintaining its operation in either of these two modes are provided in the document.

800,903
PB89-133532 PC A04/MF A01
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Intelligent Controls Group.

Manipulator Primitive Level Task Decomposition.
Technical note (Final).
A. J. Wavering. Oct 88, 56p NIST/TN-1256
Also available from Supt. of Docs. as SN003-003-02907-6.

Keywords: *Automatic control equipment, *Manipulators, Robots, *Robot manipulators, *Trajectory generation, Task decomposition interfaces, Telerobot control system, Robot control, Trajectory planning.

The document describes the structure, function, and interfaces of a trajectory generation task decomposition module in a hierarchical manipulator control system. The module generates dynamic motion and force commands from a static description of the desired behavior, and is called the Primitive (Prim) level of task decomposition, since it generates primitive motion segments. For instance, Prim can generate dynamic position and force trajectories from parametrically-defined static position and force paths. The Prim task decomposition module consists of three subcomponents; the Job Assignment module, the Planning module, and the Execution module. The operation of these modules and the internal Prim interfaces between them are discussed, showing how various trajectory planning techniques are accommodated by the task decomposition module. The discussion in the document is limited to single-arm manipulators and does not include interfaces for end effectors or active wrist devices.

800,904
PB89-133540 PC A03/MF A01
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Intelligent Controls Group.
Manipulator Servo Level Task Decomposition.
Technical note (Final).
J. C. Fiala. Oct 88, 40p NIST/TN-1255
Also available from Supt. of Docs. as SN003-003-02906-8.

Keywords: *Servomechanisms, *Automatic control equipment, *Manipulators, Robots, Nonlinear systems, Control, Task decomposition, Shared control, Teleoperation, Telerobot control system.

The document details the functionality of the Servo task decomposition modules for electric motor-powered manipulators with serial joints and unbranched kinematics. The treatment is strictly for rigid body links. In addition, the discussion is directed primarily toward autonomous mode operation. However, the document does describe the operator control interface at the Servo level. The document also describes the Servo interfaces to World Modeling, as well as the interfaces between the three task decomposition components: Job Assignment, Planning and Execution. The command interface from the Primitive task decomposition module to the Servo task decomposition module is specified, as is the interface to operator control.

800,905
PB89-137574 Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Robot Systems Div.
Hierarchical Control of Intelligent Machines Applied to Space Station Telerobots.
Final rept.,
J. S. Albus, R. Lumia, and H. McCain. 1987, 7p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Intelligent Control, Philadelphia, PA., January 19-20, 1987, p20-26.

Keywords: *Robots, Artificial intelligence, Control equipment, Space stations, Operations, Reprints, *Control systems.

A hierarchical architecture is described which supports space station telerobots in a variety of modes. The system is divided into three hierarchies: task decomposition, world model, and sensory processing. Goals at each level of the task decomposition hierarchy are divided both spatially and temporally into simpler commands for the next lower level. This signals to the robot actuators are generated. To accomplish its goals, task decomposition modules must often use information stored in the world model. The purpose of the sensory system is to update the world model as rapidly as possible to keep the model in registration with the physical world. The paper describes the architecture of the entire control system hierarchy and how it can be applied to space telerobot applications.

Tooling, Machinery, & Tools

800,906
PB88-169875 PC A04/MF A01
National Bureau of Standards, Gaithersburg, MD.
Data Execution Module of the Vertical Workstation of the Automated Manufacturing Research Facility at the National Bureau of Standards.
T. R. Kramer, and R. E. Weaver. 6 Jan 88, 65p
NBSIR-88/3704
Prepared in cooperation with Catholic Univ. of America, Washington, DC.

Keywords: *Machining, *NBS Automated Manufacturing Research Facility, *Factory automation, *Computer aided manufacturing, *Computer aided design, Workstations, National Bureau of Standards.

In the Vertical Workstation (VWS) of the NBS Automated Manufacturing Research Facility, metal parts are machined automatically from a feature-based design. A simple two-and-a-half dimensional part may be designed and machined within an hour, allowing half the time for design input. Workstation activity may be divided into design, process planning, data execution, and physical execution stages. Data execution is performed by the Data Execution Module. The module goes through a process plan and builds a model of a workpiece as machining steps from the plan are carried out. In addition, the module has five independent options, any combination of which may be carried out simultaneously: generate NC-code to make the part, enhance the process plan, emulate machining of the part by updating a picture of the part each time a step of the plan is executed, verify the process plan, and save the finished workpiece model.

800,907
PB88-194048 Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Center for Mfg. Engineering.
Robotic Tool Changing in a Horizontal Work Station.
Final rept.,
W. G. Rippey, and J. M. Vranish. 1985, 22p
Pub. in Proceedings of Conference on Robots 9, Detroit, MI., June 2-6, 1985, p2.33-2.54.

Keywords: *Machining, *Robots, *Tooling, Computer systems hardware, Computer software, Workstations.

A system is described by which the machining center of a horizontal work station has its tools transferred automatically by robot. The system provides delivery of the tools to the work station by wire guided cart, robotic removal of unwanted tools from the carousel of the horizontal machining center and placement of other tools in the carousel. A distributed control architecture including the workstation controller is outlined. System hardware is described and modifications to the machining center hardware and software are discussed.

800,908
PB88-195144 Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Precision Engineering Div.
Error Compensation of Coordinate Measuring Machines.
Final rept.,
G. Zhang, R. Veale, T. Charlton, B. Borchardt, and R. Hocken. 1985, 4p
Pub. in CIRP Annals 34, n1 p445-448 1985.

Keywords: *Measuring instruments, Coordinates, Correction, Errors, Reprints, *Coordinate measuring machines, Gage blocks.

The methods and results are presented for applying software error compensation to a commercial three axis coordinate measuring machine. The technique incorporates compensation for geometric positioning errors and some thermal effects. The effectiveness of the method is tested by measuring linear displacement along arbitrarily oriented lines through the workzone and by measuring the length of a 500 mm gage block in several orientations. The results show a factor of ten performance improvement (limited by measurement repeatability) over 0.5 C range in temperature.

800,909
PB88-204854 Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Factory Automation Systems Div.

MANUFACTURING TECHNOLOGY

Tooling, Machinery, & Tools

Process Planning for a Milling Machine from a Feature-Based Design.

Final rept.,
T. R. Kramer. 1988, 11p
Sponsored by Catholic Univ. of America, Washington, DC.
Pub. in Proceedings of Manufacturing International Symposium on Manufacturing Systems - Design, Integration, and Control, Atlanta, GA., April 17-20, 1988, p179-189.

Keywords: *Milling(Machining), *Machining, Controllers, *Computer aided design, *Computer aided manufacturing, Automated Manufacturing Research Facility, Computer software, VWS system, LISP programming language.

In the Vertical Workstation (VWS) of the NBS Automated Manufacturing Research Facility, metal parts are machined automatically from a feature-based design. A simple two-and-a-half dimensional part may be designed and machined within an hour, allowing half the time for design input. With a design already on hand, the VWS software (which is written in LISP and runs on a Sun computer) will automatically prepare a process plan for a milling machine for making a part of the given design. The heart of the process plan is a list of machining operations to be carried out.

800,910

PB88-234844 PC A03/MF A01
National Bureau of Standards (NBS), Gaithersburg, MD.

Simple Method for Measuring Straightness of Coordinate Measuring Machines.

Final rept.,
A. K. Elshennawy, and F. S. Jing. May 88, 40p
NBSIR-88/3759

Keywords: Straightness, Coordinates, Graphs(Charts), *Coordinate measuring machines, Ball bars, Laser interferometry.

Straightness errors contribute significantly to the total error budget of coordinate measuring machines. There are two straightness error parameters for each axis: horizontal and vertical straightness. According to Bryan, straightness error is 'a non-linear movement of the machine axis that an indicator sees when it is either stationary reading against a perfect straight edge supported on a moving slide or moved by the slide along a perfect straight edge which is stationary.' Thus, straightness error can be determined as the deviation of measurement data from a straight line. For the purpose of calibrating coordinate measuring machines, a laser interferometer system equipped with straightness optics is usually used to measure straightness. In addition to the relative high cost of a laser interferometer system, it needs an experienced operator to perform the measurements. A simple and rapid method for measuring the straightness of coordinate measuring machines was developed using the ball bar.

Tribology

800,911

PB88-168604 PC A07/MF A01
National Bureau of Standards, Gaithersburg, MD.

Towards a Tribology Information System: The Results of a Planning Workshop Held at the National Bureau of Standards, July-August 1985.

Special pub. (Final),
J. Rumble, and L. Sibley. Dec 87, 130p NBS/SP-737
Also available from Supt. of Docs. as SN003-003-02843-6. Library of Congress catalog card no. 87-619902. Sponsored by Department of Energy, Washington, DC., and American Society of Mechanical Engineers, New York.

Keywords: *Tribology, *Information systems, *Meetings, Data bases, Friction, Wear.

A workshop was held in July 1985 to address the needs for a computerized tribology information and data system, as well as possible implementation schemes. Specific categories that were treated were design, numeric data, bibliography, research in progress, newsletter, and product directory. The workshop recommendations detailed four phases of development, starting with a demonstration prototype system and concluding with a full-scale operating data and information base. Specific plans in each phase

and for each subject area were developed and are presented here. While continual input will be sought from the technical community to refine those plans, it is hoped that immediate efforts can begin in at least some of the areas, and that system use will quickly develop to a significant level, both nationally and internationally.

800,912

PB89-119119 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Model for Run-In and Other Transitions in Sliding Friction.

Final rept.,
P. J. Blau. 1986, 7p
Sponsored by American Society of Mechanical Engineers, New York.
Pub. in Proceedings of ASME/ASLE (American Society of Mechanical Engineers/American Society of Lubrication Engineers) Joint Tribology Conference, Pittsburgh, PA., October 20-22, 1986, 7p.

Keywords: *Sliding friction, Lubrication, Surface roughness, Mathematical models, Reprints, *Tribology, Kinetic friction coefficient.

The mathematical framework for a sliding friction model for run-in and other tribological transitions is presented. The semi-empirical model was developed to portray the commonly observed shapes, durations, and variations in kinetic friction coefficient versus sliding time curves. Terms in the model involve material properties and physical interface conditions such as transfer, debris accumulation, and surface roughness. The forms of individual terms are adjustable through the use of system-specific scaling parameters in order to provide enough modeling flexibility to treat a variety of possible tribological conditions. Effects of lubrication efficiency loss over time, and temperature build-up can be incorporated by modification of appropriate terms. Illustrative plots using the framework with several combined contributions are compared with experimental data from previous work. The basic framework of the model can be further developed as sub-models for specific sliding friction contributions become available and, in so doing, reduce the number of empirical system parameters required to model actual tribosystem behavior.

800,913

PB89-129530 PC A06/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Formation of Lubricating Films at Elevated Temperatures from the Gas Phase.

Special pub. (Topical),
E. E. Klaus, J. L. Duda, S. K. Naidu, R. G. Munro, and S. M. Hsu. Sep 88, 103p NIST/SP-744
Also available from Supt. of Docs. Library of Congress catalog card no. 88-600554. Prepared in cooperation with Pennsylvania State Univ., University Park. Dept. of Chemical Engineering. Sponsored by Department of Energy, Washington, DC.

Keywords: *High temperature lubricants, *Polymeric films, *Bearings, *Tribology, Vaporizing, Air, Degradation, Oxidation, Melting points, Nitrogen, Friction, Polymers, Esters, Ethers, Mineral oils, Graphs(Charts), Alkyl phosphate esters, Aryl phosphate ester, Organic acid esters, Polyphenyl ethers.

Conventional liquid lubricants, when subjected to temperatures of 250 deg C and above for extended time in an air atmosphere, degrade rapidly to make large amounts of solid sludge and deposits. Based on boundary lubrication of bearings, these same lubricants, when subjected to 250 deg C to the melting point of the bearing metal, produce in the micro- to milli-second residence time in the bearing contact enough 'friction polymer' to result in good lubrication. The report describes the use of these conventional liquid lubricants delivered in a homogeneous vapor phase where the carrier gas is nitrogen, air or mixtures of these two gases. The lubricants studied include alkyl and aryl phosphate esters, organic acid esters, polyphenyl ethers, and mineral oil.

General

800,914

PB88-175252 Not available NTIS

Role of the National Bureau of Standards in Supporting Industrial Innovation.

Final rept.,
G. Tassey. 1986, 10p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Engineering Management EM-33, n3 p162-171 Aug 86.

Keywords: *Innovation, Reprints, *Industrial innovation, National Bureau of Standards.

The economic role of the National Bureau of Standards is analyzed within the context of the innovation process and the various rationales for government support of the process. Industry is found to systematically underinvest in evaluated data and such nonproprietary infrastructure needs technologies as evaluated data measurement standard and test methods. The causes of underinvestment by industry in measurement related data and technologies are described and the efficiency gains from NBS provision are explained. Because much of the measurement technology developed by NBS is adopted by industry in the form of voluntary standards, the economic roles of such standards are described and examples given. Criteria are synthesized for a government laboratory's role in producing and transferring measurement-related data and technologies, and examples of economic impact studies of the NBS economic roles are discussed.

800,915

PB88-239488 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Analytical Model of Orifice Pulse-Tube Refrigerator.

Final rept.,
R. Radebaugh, and P. Storch. 1987, 6p
Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Pub. in Proceedings of the International Congress of Refrigeration (17th), Wein, Austria, August 24-29, 1987, p45-50.

Keywords: *Refrigerators, *Cryocoolers, *Cryogenic equipment, *Pulse tube refrigerators, Thermoacoustics.

Orifice pulse-tube refrigerators have high refrigeration capacities and can produce temperatures down to 60K in one stage. The paper discusses a relatively simple analytical model which describes their behavior and can be used to optimize and improve the refrigeration capacity. A thermodynamic analysis shows that the refrigeration power is equal to the time-averaged enthalpy flow in the pulse tube. By assuming sinusoidal behavior for the mass flow rate and pressure oscillations, these waves can be represented with phasors in the frequency-domain. Heat transfer to the pulse tube wall is assumed to be zero except for the two ends. Gas flow through the orifice gives rise to composite pressure, temperature, and mass flow phasors, which are calculated and used to derive the time-averaged enthalpy flow. The result shows the effect of gas properties, pressure ratio, pressure, frequency, and orifice setting on refrigeration power.

800,916

PB88-239769 PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Machine Intelligence Group.

Converting the AMRF Part Model Report to a PDES/STEP Subset: A Preliminary Implementation.

Y. T. Lee, and S. Ressler. Jul 88, 42p NBSIR-88/3818

Keywords: Mathematical models, Computer programs, *US NBS Automated Manufacturing Research Facility, Data conversion routines, File structures.

The paper identifies the process through which the Topology and Geometry of product data defined in the AMRF (Automated Manufacturing Research Facility) Part Model database report are converted to the PDES (Product Data Exchange specification)/STEP (Standard for the Exchange of Product Model Data) physical file. A file conversion program, which converts the AMRF Part Model report (topology and geometry only) to the PDES/STEP file, has been implemented. The PDES/STEP file can be generated 100 percent automatically by executing the program.

800,917
PB89-114029 PC A04/MF A01
 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Impact of Refrigerant Property Uncertainties on Prediction of Vapor Compression Cycle Performance.
 P. A. Domanski, and D. A. Didion. Feb 87, 52p
 NBSIR-86/3373
 Contract DE-AC05-84OR21400
 Sponsored by Oak Ridge National Lab., TN.

Keywords: *Refrigerants, *Heat pumps, *Vapor compression refrigeration cycle, Air conditioners, Sensitivity analysis, Thermodynamic properties, Transport properties, Computerized simulation, Heat transfer.

The paper presents a sensitivity study of a vapor compression cycle in the form of a heat pump operating in the cooling mode. The study was performed with the aid of a detailed heat pump computer model; simulation runs were made for different parametric values and the capacity and power input were compared with results of a run using an unchanged value of the parameters. The effects on evaporator and condenser pressures, and refrigerant mass flow rate are given. The independent variables (parameters) include thermodynamic and transport properties, as well as the refrigerant flow heat transfer and pressure drop coefficients. When considering the state-of-the-art limits of the individual parameter uncertainties, those which had the most effect on system performance were liquid transport properties, evaporative heat transfer coefficient and vapor density.

800,918
PB89-125009 Not available NTIS
 National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Versatile Experimental Low-Power 4 K Cryocooler.
 Final rept.,
 N. Lambert, S. Barbanera, and J. E. Zimmerman.
 1986, 5p
 Pub. in Jnl. of Cryogenics 26, n6 p341-345 Jun 86.

Keywords: Joule-Thomson effect, Refrigerating, Compressors, Pneumatic control, Helium, Diffusion, Plastics, Cryogenics, Reprints, *Cryocoolers.

The construction of a low power cryocooler consisting of a 5-stage plastic Stirling cooler with an additional Joule-Thomson stage is described. Among its novel features are a contamination free, pneumatic helium compressor and displacer drive. Valve timing is under computer control. Titanium foil embedded in the cylinder wall reduces helium diffusion through the plastic. The Joule-Thomson stage used the same low pressure helium as the Stirling stages. The Stirling system cools down below 9 K. The Joule-Thomson stage delivers 5 mW cooling at 4.2 K.

800,919
PB89-129142 PC A04/MF A01
 National Bureau of Standards, Gaithersburg, MD.
Statistical Concepts in Metrology-With a Postscript on Statistical Graphics.
 Special pub. (Final).
 H. H. Ku. Aug 88, 52p NBS/SP-747
 Also available from Supt. of Docs. as SN003-003-02892-4. See also AD-A077 630. Library of Congress catalog card no. 88-600569.

Keywords: *Metrology, *Calibrating, Measurement, Graphic methods, Statistical analysis, Accuracy, Errors, Probability theory, Statistical graphics.

'Statistical Concepts in Metrology' was originally written as Chapter 2 for the Handbook of Industrial Metrology published by the American Society of Tool and Manufacturing Engineers, 1967. It was reprinted as one of 40 papers in NBS Special Publication 300, Volume I, Precision Measurement and Calibration; Statistical Concepts and Procedures, 1969. Since then this chapter has been used as basic text in statistics in Bureau-sponsored courses and seminars, including those for Electricity, Electronics, and Analytical Chemistry. While concepts and techniques introduced in the original chapter remain valid and appropriate, some additions on recent development of graphical methods for the treatment of data would be useful. Graphical methods can be used effectively to 'explore' information in data sets prior to the application of classical statistical procedures. For this reason additional sections on statistical graphics are added as a postscript.

MATERIALS SCIENCES

Adhesives & Sealants

800,920
PB89-137533 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Methacrylate Oligomers with Pendant Isocyanate Groups as Tissue Adhesives.
 Final rept.,
 G. M. Brauer, and C. H. Lee. 1988, 5p
 Pub. in Proceedings of ACS (American Chemical Society) Division of Polymeric Materials: Science and Engineering, Los Angeles, CA., September 25-30, 1988, v59 p397-401.

Keywords: *Adhesives, *Methacrylates, *Medical supplies, Tissues(Biology), Isocyanates, Synthesis(Chemistry), Bones, Dental materials, Compositions, Veterinary medicine, Reprints, *Tissue adhesives, Oligomers, Bone adhesives.

Oligomers containing pendant isocyanate groups and residual double bonds were synthesized from 2-isocyanatoethyl methacrylate (IEM) and/or m-isopropenyl dimethylbenzyl isocyanate (TMI) and methacrylate or vinyl monomers. The oligomers are stable in air, have a MW range from 1400 to 2600 and an -NCO content from 3 to 18%. The compounds, especially those with TMI or IEM and TMI and methacrylate constituents dissolved in suitable solvents yield stronger, more permanent bonds to bone than other tissue adhesives. No deterioration of bond strength occurs on thermocycling in water between 5 and 55 C for one week. No correlation between bonding efficiency and -NCO content could be established. Vinyl monomers containing oligomers are preferable to bond dentin to dental restoratives. These compositions are also excellent soft tissue adhesives, e.g. to join calfskin to itself or to denture resins. Subject to their biocompatibility the formulations could find many applications in medicine, dentistry and veterinary science.

Ceramics, Refractories, & Glass

800,921
PATENT-4 771 022 Not available NTIS
 Department of Commerce, Washington, DC.
High Pressure Process for Producing Transformation Toughened Ceramics,
 Patent,
 S. Block, and G. J. Piermarini. Filed 18 Feb 87, patented 13 Sep 88, 7p PB89-107247, PAT-APPL-7-015 577
 This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Production methods, *Ceramics, *Patents, Phase control, Zirconium oxides, Toughness, Densification, Phase transformations, Hydrostatic pressing, High pressure, Toughening agents.

Toughening agents are produced by the application of high pressure, sufficient to transform a powder material into a denser high pressure polymorph. When the pressure is released, the high pressure phase is retrieved metastably at ambient conditions of pressure and temperature. The amount of high pressure phase retained at ambient conditions depends on the relative hydrostaticity of the pressurized environment and particle size of the powder. The high pressure phase is almost completely retained in a hydrostatic environment. One embodiment of the process of the present invention produces pressure transformation toughened zirconia comprising a high pressure phase having a symmetry no greater than tetragonal (defined as tetragonal II) dispersed within a matrix of a less dense monoclinic phase.

800,922
PATENT-4 772 524 Not available NTIS

Department of Commerce, Washington, DC.
Fibrous Monolithic Ceramic and Method for Production,
 Patent,
 W. S. Coblenz. Filed 14 Apr 86, patented 20 Sep 88, 12p PB89-114540, PAT-APPL-6-851 607
 Supersedes PB86-220332.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Ceramic fibers, *Ceramic composites, *Patents, Ceramics, Refractories, Production, Sintering, High temperature.

The present invention is a fibrous monolithic ceramic product of high density and a process for making the product. The product has a microstructure of coated fibers with planes of weakness between a core of each coated fiber and its respective coat or between each coated fiber and adjacent coated fibers, thereby toughening the product. The planes of weakness are sufficiently weak to deflect a crack from normal to the plane of weakness to a direction parallel to the plane of weakness. The green body from which the product is formed, can be plastically deformed at room temperature, formed in near-net-shape, and densified by pressureless sintering.

800,923
PB88-175377 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Determination of Boron in Borosilicate Glasses by Neutron Capture Prompt Gamma-Ray Activation Analysis.
 Final rept.,
 J. E. Riley, and R. M. Lindstrom. 1987, 7p
 Pub. in Jnl. of Radioanalytical and Nuclear Chemistry 109, n1 p109-115 1987.

Keywords: *Borosilicate glass, *Nondestructive tests, *Radioactivation analysis, Boron, Reprints.

The boron contents of borosilicate glasses have been determined nondestructively by neutron activation analysis. In contrast to chemical methods for determining boron as a major component, the described nuclear method has few interferences and does not require chemical separation of boron prior to its quantitation. The effects of neutron self-shielding by boron (1 to 8% by weight) are examined, minimized by dilution of powdered samples with high purity graphite, and circumvented by comparative analyses.

800,924
PB88-175500 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Influence of Cement Alkali Distribution on Expansion Due to Alkali-Silica Reaction.
 Final rept.,
 L. Struble, and S. Diamond. 1986, 15p
 Sponsored by National Science Foundation, Washington, DC.
 Pub. in ASTM (American Society for Testing and Materials) Special Technical Publication, Alkalies Concr. 930, p31-45 1986.

Keywords: *Portland cements, *Alkali aggregate reactions, Concretes, Silicon dioxide, Mortars(Material), Reprints.

To contribute to a better understanding of the mechanisms controlling alkali-silica reaction, a study was carried out to show if the alkali mineralogy of the cement influences the expansion of mortar containing reactive aggregate. The approach was to determine the distribution of alkalis within a group of commercial portland cements with a variety of alkali mineralogies, and to measure expansion of mortar bars prepared using these cements and reactive aggregates.

800,925
PB88-175591 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Low Temperature Phase Relationships in the System ZrO₂-TiO₂.
 Final rept.,
 A. E. McHale, and R. S. Roth. 1986, 6p
 Pub. in Jnl. of the American Ceramic Society 69, n11 p827-832 Nov 86.

MATERIALS SCIENCES

Ceramics, Refractories, & Glass

Keywords: *Titanium oxides, *Zirconium oxides, Phase transformations, Reprints.

The phase relationships in the system ZrO_2 - TiO_2 near the compound $ZrTiO_4$ have been clarified through an experimental study involving the characterization of both single crystal and powder specimens, the latter prepared through conventional solid state reaction and also by low temperature coprecipitation methods.

800,926

PB88-175617

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Crack Stability and Toughness Characteristics in Brittle Materials.

Final rept.,

Y. W. Mai, and B. R. Lawn. 1986, 25p

Sponsored by Office of Naval Research, Arlington, VA. Pub. in Annual Review of Materials Science, v16 p415-439 1986.

Keywords: *Ceramics, Cracking(Fracturing), Toughness, Equilibrium methods, Reprints.

No abstract available.

800,927

PB88-175633

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Closure and Repropagation of Healed Cracks in Silicate Glass.

Final rept.,

T. A. Michalske, and E. R. Fuller. 1985, 5p

Pub. in Jnl. of the American Ceramic Society 68, n11 p586-590 Nov 85.

Keywords: *Silica glass, *Cracks, Reprints.

Cracks in soda-lime-silica and vitreous silica glass close against a finite load at humidities between 0.01% and 100%. The force associated with crack closure can be predicted by a model which involves hydrogen bonded linkages of surface adsorbed water molecules. The fracture energy to reopen healing cracks in vitreous silica is also in the range of hydrogen bonding interactions. At the driest environments used, healed cracks to soda-lime-silica glass required 1.7 ± 0.2 J/sq.m to reopen. The bonding energy can be attributed to either the formation of cationic bridges or siloxane bonds between fracture surfaces.

800,928

PB88-176938

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Experimental Glass Failure Data and Equivalent One-Minute Loads.

Final rept.,

E. Simiu, and J. A. Lechner. 1987, 6p

Pub. in Jnl. of Structural Engineering 113, n12 p2503-2508 Dec 87.

Keywords: *Glass, *Crack propagation, Window glass, Fractures(Materials), Statistics, Reprints, Building materials, Wind loads.

The validity of procedures for estimating equivalent 1-min loads depends upon the extent to which Wiederhorn's phenomenological description of subcritical crack growth is acceptable for the range of loading rates characterizing the wind or laboratory loads of interest. The objective of the paper is to examine the question whether the use of the description for the purpose of estimating equivalent 1-min loads is acceptable for a wide range of loading rates.

800,929

PB88-176946

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Design Criteria for Glass Cladding Subjected to Wind Loads.

Final rept.,

E. Simiu, and E. M. Hendrickson. 1987, 18p

Pub. in Jnl. of Structural Engineering 113, n3 p501-518 Mar 87.

Keywords: *Glass, *Cladding, Design, Reliability, Reprints, Building materials, Wind loads.

The safety and cost of glass cladding facades subjected to wind loads depend upon the criteria used for their design. These criteria specify the design wind loads and the allowable panel loads. The present paper re-

views the following: (1) the evolution in recent years of methods for the estimation and specification of design wind loads for building facades; (2) recent developments concerning the estimation and specification of allowable loads for glass cladding panels, and controversies surrounding these developments; and, (3) recent developments in structural reliability as applied to glass cladding, which allow rational decisions to be made concerning the adoption of satisfactory design criteria specifying both design wind loads and allowable panel loads.

800,930

PB88-189527

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Indentation Deformation and Fracture of Sapphire.

Final rept.,

H. M. Chan, and B. R. Lawn. 1988, 7p

Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.

Pub. in Jnl. of the American Ceramic Society 71, n1

p29-35 1988.

Keywords: *Sapphire, *Crack initiation, *Fracturing, Deformation, Reprints, Transmission electron microscopy, Kikuchi lines.

Relatively little is known about the fundamental deformation processes in intrinsically hard, brittle materials, and even less about how these processes lead to the initiation of cracks. In the paper, transmission electron microscopy is used to study the deformation structure within Vickers indentation zones of single-crystal sapphire with (11-2)00 surface orientation. Two principal types of deformation are identified, basal twinning and pyramidal slip. Incipient microcracks are observed at both the twin interfaces and the slip planes. These incipient 'flaws' act as nucleation sites for the ensuing radial and lateral cracks.

800,931

PB88-189949

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Effects of Counter Ions on Crack Growth in Vitreous Silica.

Final rept.,

G. S. White, S. W. Freiman, S. M. Wiederhorn, and

T. D. Coyle. 1987, 5p

Pub. in Jnl. of the American Chemical Society 70, n12 p891-895 1987.

Keywords: pH, Reprints, *Chemical attack, *Counter ions, Crack growth, *Silica, Surface forces.

Crack-growth studies on vitreous silica were conducted in aqueous solutions as a function of pH in the range 1 to 14. Slopes of crack velocity-K1 curves were steeper in acidic and neutral solutions than in basic solutions. Of the four alkali-metal hydroxide solutions studied, only lithium hydroxide behaved differently from the others and only in concentrated, equal to or greater than 1M, solutions. At this concentration, the slope and position of the crack-growth curves for LiOH were nearly identical to those obtained in acidic or neutral solutions. It is suggested that the influence of alkali-metal hydroxides on crack growth is largely chemical in nature, involving short-range forces associated with the breaking of bonds at the crack tip. Two mechanisms for chemical attack are considered: in basic solutions the siloxane bonds at the crack tip are believed to be attacked directly by the hydroxide ions in solution.

800,932

PB88-190202

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Thresholds and Reversibility in Brittle Cracks: An Atomistic Surface Force Model.

Final rept.,

B. R. Lawn, D. H. Roach, and R. M. Thomson. 1987, 15p

Sponsored by Office of Naval Research, Arlington, VA. Pub. in Jnl. of Materials Science 22, p4036-4050 1987.

Keywords: *Crack propagation, *Fracturing, Silicon dioxide, Sapphire, Mica, Brittleness, Glass, Surfaces, Reprints.

A new picture of environmentally-enhanced fracture in highly brittle solids is presented. It is asserted that the fundamental relations for crack growth are uniquely expressible in terms of the surface force functions that govern the interactions between separating walls in an

intrusive medium. These functions are the same, in principle, as those measured directly in the newest submolecular-precision microbalance devices. A fracture mechanics model, based on a modification of the Barenblatt cohesive zone concept, provides the necessary framework for formalizing this link between crack relations and surface force functions.

800,933

PB88-193974

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Young's Modulus and Thermal Diffusivity Measurements of Barium Titanate Based Dielectric Ceramics.

Final rept.,

G. S. White, C. Nguyen, and B. Rawal. 1987, 12p

Sponsored by Office of Naval Research, Arlington, VA., and AVX Corp., Great Neck, NY.

Pub. in Proceedings of Conference on Nondestructive Testing of High Performance Ceramics, Boston, MA., August 25-27, 1987, 12p.

Keywords: *Barium titanates, *Modulus of elasticity, *Thermal diffusivity, *Dielectrics, Ultrasonic tests, Capacitors, Photoacoustic effect.

Young's modulus and thermal diffusivity values have been obtained on a set of barium titanate based ceramics, using ultrasonic pulse-echo and photoacoustic effect (PAE) measurements. The PAE was shown to detect variations in thermal diffusivity between materials of varying composition and processing treatments. The results are valuable in the evaluation of dielectric ceramic materials for practical electronics applications.

800,934

PB88-193982

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Characteristic Cavity and Microcrack Distributions in alpha SiC, Si3N4 and ZrO2.

Final rept.,

N. J. Tighe, K. A. Hardman-Rhyne, and Y. N. Lu.

1985, 14p

Sponsored by Army Materials and Mechanics Research Center, Watertown, MA., and Air Force Office of Scientific Research, Bolling AFB, DC.

Pub. in Proceedings of Annual Conference on Composites and Advanced Ceramic Materials (9th), Cocoa Beach, FL., January 20-23, 1985, p835-848.

Keywords: *Silicon carbides, *Silicon nitrides, *Zirconium oxides, *Cracks, Neutron diffraction, Electron microscopy, Crystal defects, Transmission electron microscopy, Small angle scattering, Microcracks.

Transmission Electron Microscopy and small angle neutron diffraction were used to characterize cavities and microcracks in hot-pressed silicon nitride and in sintered alpha silicon carbide. The results show that heavy concentrations of neutron scattering inclusions in Si3N4 impede neutron diffraction analysis but the microcrack population in the graphite inclusions in SiC can be detected. Some preliminary electron microscopy of partially stabilized zirconia indicates the material is a good candidate for SANS analysis as a non-destructive technique to follow the changes in microcracking that result from phase transformations.

800,935

PB88-195029

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Interfacial Layers in Brittle Cracks.

Final rept.,

D. H. Roach, S. Lathabai, and B. R. Lawn. 1988, 9p

Sponsored by Office of Naval Research, Arlington, VA. Pub. in Jnl. of the American Ceramic Society 71, n2 p97-105 Feb 88.

Keywords: *Mica, *Glass, Surfaces, Corrosion, Brittleness, Cracks, Reprints, Interfacial layers.

A study has been made of interfacial layers that form within cracks in mica and silicate glass. The layers are the result of interactions with environmental species behind the crack tip. Deposition processes are associated with precipitation from aqueous solutions and corrosion of the crack walls. The level of precipitation depends on such factors as 'impurity' content, temperature, etc. The results highlight the potential importance of surface chemistry as a determinant of both equilibrium and kinetic fracture properties.

800,936

PB88-195045

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Transformation Toughening in Large-Grain-Size CeO₂-Doped ZrO₂ Polycrystals.

Final rept.,

T. W. Coyle, W. S. Coblenz, and B. A. Bender. 1988, 5p

Pub. in Jnl. of the American Ceramic Society 71, n2 pC-88-C-92 Feb 88.

Keywords: *Zirconium oxides, Fracture properties, Cerium oxides, Polycrystals, Toughness, Tetragonal lattices, Monoclinic lattices, Reprints, *Crystal-phase transformations, Doped materials.

The fracture and transformation behavior of tetragonal polycrystalline ZrO₂ alloys containing 18 mol% CeO₂(Ce-TZP) was investigated. In the absence of applied stress the tetragonal phase was found to be stable in large-grained (>30 micrometers) samples at room temperature. The monoclinic phase was detected in regions of high residual stress near hardness indentations although no evidence of a wake of monoclinic phase along the fracture surface was observed. The fracture toughness increased as density and/or grain size increased. It is proposed that the relatively high toughness of these materials is due to the occurrence of stress-driven tetragonal-to-monoclinic transformation near the crack tip, which reverses when the crack has passed.

800,937

PB88-204896

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Adsorption Phenomena on Glass Surfaces. 4. Surface Acidity of Silica and Glasses.

Final rept.,

J. Jednacak-Biscan, V. Pravdic, and W. Haller. 1988, 10p

Pub. in Jnl. of Colloid and Interface Science 121, n2 p345-354 Feb 88.

Keywords: *Surface chemistry, *Silicon gel, *Glass, Adsorption, Amines, Silicon dioxide, Reprints.

Batch and flow microcalorimetry were used to study adsorption of aliphatic amines on silica gel, controlled pore glass (CPG), high alumina glass, and surface-derivatized controlled pore glass. The adsorption of basic aliphatic amines is indicative of the acidity of the surface. Silica gel and controlled pore glass show the same average heat of adsorption for butylamine, 35 + or - 2kJ/mole, but the CPG, in contrast to the silica gel has nearly homoenergetic surface. High alumina glass (17% Al₂O₃) has a less acidic surface, and the relevant value for the heat of adsorption of butylamine is only 4.7 kJ/mole. Surface derivatization with a long-chain aliphatic silane (octadecylsilane) produces a highly hydrophobic surface, when water molecules are used as probes. Interaction with butylamine remains strong, as in the original state of CPG. Derivatization with aminopropylsilane yields a basic surface and the interaction with butylamine is weak, showing a heat of adsorption of only 3-4 kJ/mole. The paper indicates that surface acidity of silica and glasses can be understood only as an interactive process between the surface and the adsorbate.

800,938

PB88-215421

PC A03/MF A01

National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Round-Robin Measurements of the Apparent Thermal Conductivity of Two Refractory Insulation Materials, Using High-Temperature Guarded-Hot-Plate Apparatus.

J. G. Hust, and D. R. Smith. Apr 88, 31p NBSIR-88/3087

Sponsored by Oak Ridge National Lab., TN.

Keywords: *Thermal conductivity, High temperature, Insulation, *Refractory thermal insulation, Round robin, Guarded hot plate apparatus.

The report presents the test results and analysis of round-robin measurements of apparent thermal conductivity for two kinds of refractory insulation board using high-temperature guarded-hot-plate apparatus. The round robin was carried out under the sponsorship of the American Society for Testing and Materials (ASTM) Subcommittee C-16.30 on Thermal Measurements. To complete the measurement program in a

timely manner the participants chose to measure different specimens, selected, however, from the same production lot. The test results for apparent thermal conductivity illustrate the inter-laboratory reproducibility as well as the temperature and density dependence. The data include the temperature range from 297 to 773 K. The standard deviation is 7.4% for the 48 test results reported by seven participating laboratories for fibrous alumina-silica. The standard deviation is 8.0% for the 58 test results reported for calcium silicate.

800,939

PB88-215447

PC A04/MF A01

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Advanced Ceramics: A Critical Assessment of Database Needs for the Natural Gas Industry.

Topical rept. Jun 86-May 87,

C. R. Hubbard, S. J. Dapkunas, R. G. Munro, and S. M. Hsu. May 88, 58p NBSIR-88/3706, GRI-88/0074, CAM-8701

Contract GRI-5084-238-1302

Sponsored by Gas Research Inst., Chicago, IL., and Pennsylvania State Univ., University Park. Center for Advanced Materials

Keywords: *Ceramics, Heat resistant materials, Corrosion resistance, Structural properties, Thermophysical properties, Electrical properties, Mechanical properties, Heat exchangers, Regenerators, Internal combustion engines, Fuel cells, *Gas fired environments, *Data bases, *Natural gas industry, *Structural materials, High temperature environments, Heat engines, Data compilation.

A comprehensive survey was conducted to identify the materials properties of potential importance for inclusion in an advanced structural ceramics database. The materials of current interest for use in gas-fired heat exchangers, recuperators, radiant tubes, and heat engines were determined. Existing computerized, numerical databases were surveyed and those relevant to the materials and application of interest are detailed. Analysis of the results revealed that existing databases were inadequate to fulfill the critical data needs for effective applications of advanced ceramics in gas-fired, high-temperature applications. Requirements for establishing a new database focussed on these materials, and applications are presented.

800,940

PB88-217617

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Diffusion Induced Interface Migration in Ceramics.

Final rept.,

J. E. Blendell, C. A. Handwerker, C. A. Shen, and N. D. Dang. 1988, 8p

Pub. in Ceramic Microstructures '86, p541-548 1988.

Keywords: *Ceramics, *Boundary layer, Interfaces, Diffusion, Magnesium oxides, Nickel oxides, Cobalt oxides, Surface chemistry, Migrations.

Diffusion Induced Grain Boundary Migration (DIGM) and Liquid Film Migration (LFM) have been observed in the MgO system. NiO, CoO, or mixtures of the two, have been used to induce the migration. Interfaces are observed to migrate away from their radii of curvature, and alloying has occurred in the regions swept by the interface. The results agree with the model which gives the coherency strain as the driving force for this migration.

800,941

PB88-217625

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Effects of Composition and Environment on the Fracture of Fluoride Glasses.

Final rept.,

S. W. Freiman, and T. L. Baker. 1988, 3p

Pub. in Jnl. of the American Ceramic Society 71, n4 pC214-C216 Apr 88.

Keywords: *Fracturing, Crack propagation, Fracture strength, Chemical composition, Stress corrosion, Reprints, *Fluoride glasses.

Indentation-crack-length procedures were used to determine the critical fracture toughness (K sub IC) and the sensitivity to environmentally enhanced crack growth in heavy-metal fluoride glasses of varying chemical composition. The data show that while K sub IC was more or less invariant with composition, some

glasses were more susceptible to subcritical crack growth than others. The results are interpreted in terms of existing crack-growth models. A technique for predicting K sub IC from fundamental atomic bonding and crystal-structure data for these glasses is discussed.

800,942

PB88-217641

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Influence of Microstructure on Creep Rupture.

Final rept.,

S. M. Wiederhorn, B. J. Hockey, and R. F. Krause. 1988, 12p

Sponsored by Department of Energy, Washington, DC. Pub. in Ceramic Microstructures '86, p795-806 1988.

Keywords: *Microstructure, *Creep rupture strength, Deformation, Fracturing, Crystallization, Strains, Glass, Vitreous state, Intergranular corrosion, Creep(Materials), Viscosity, Creep rate, Aluminum oxide.

In the paper, the effect of microstructure on both the creep and creep rupture behavior of two commercial grades of vitreous bonded aluminum oxide was investigated. Deformation and fracture occurred within the ductile, intergranular phase of the material. The creep rate was relatively insensitive to the amount of intergranular phase, but was sensitive to structural details of that phase. The creep rate could be reduced by increasing both the degree of crystallization of the intergranular phase and the viscosity of residual glass within that phase. The time-to-rupture and the strain-at-rupture increased as the amount of intergranular phase within the material increased. The data fit a modified Monkman-Grant curve in which the Monkman-Grant coefficient was sensitive to both stress and the amount of intergranular phase. The Monkman-Grant coefficient was not sensitive, however, to the degree of crystallization of the intergranular phase.

800,943

PB89-119143

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Observation of Two Structurally Distinct States in Ni-P Glasses Using EXAFS (Extended X-ray Absorption Fine Structure).

Final rept.,

A. I. Goldman, G. G. Long, L. H. Bennett, D. S. Lashmore, and M. Kuriyama. 1988, 3p

Pub. in Jnl. of the Electrochemical Society 135, n8 p1919-1921 1988.

Keywords: *Nickel, *X-ray fluorescence, *Phosphorus, *Glass, X-ray spectroscopy, Emission spectra, Vitreous state, Micro structure, Reprints.

Two structurally distinct states in Ni-P glasses have been observed using the EXAFS technique. The transition between these states cannot be understood within the bounds of a continuous structural relaxation mechanism.

800,944

PB89-119267

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Temperature Dependence of Hardness of Alumina-Based Ceramics.

Final rept.,

C. P. Alpert, H. M. Chan, S. J. Bennison, and B. R. Lawn. 1988, 3p

Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.

Pub. in Jnl. of the American Ceramic Society 71, n8 pC-371-C-373 Aug 88.

Keywords: *Ceramics, *Aluminum oxide, *Hardness tests, Temperature, Shear modulus, Phase transformations, Polycrystals, Single crystals, Sapphire, Gems, Reprints, Peierls stresses.

Hardness was measured as a function of temperature (20 deg to 1000 deg C) for several alumina ceramics, including single-crystal sapphire and polycrystalline aluminas containing different amounts of second phase. Hardness decreased steadily with increasing temperature for all materials tested, in accordance with a semi-empirical relation of the form H=H sub 0(1-T/T sub 0). The behavior conformed with a thermally activated slip process, limited by Peierls stresses. At lower temperatures, the hardness values

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for debased aluminas were less (smaller $H_{sub 0}$) than for the pure materials, consistent with a reduction in shear modulus resulting from the 'soft' phase. However, at higher temperatures the hardness values for all the aluminas converged (identical $T_{sub 0}$, i.e., material-invariant activation energy). The latter behavior indicated that the temperature dependence of the indentation deformation was controlled predominantly by the alumina component.

800,945

PB89-123988

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Calculation of Phase Diagrams of Some Oxide Systems Using the Cluster Variation Method.

Final rept.,

R. Kikuchi, and B. P. Burton. 1988, 10p

Pub. in *Physica B* 150, p132-141 1988.

Keywords: *Face centered cubic lattices, *Minerals, *Phase diagrams, *Ceramics, *Cluster sampling, *Computation, Magnetite, Iron oxides, Calcium carbonates, Magnesium carbonates, Titanium oxides, Reprints, Cluster variation method.

For calculating phase diagrams of mineral/ceramic systems, the cluster variation method (CVM) is a useful tool. The CVM is a hierarchy in which the approximations based on point- and pair-clusters correspond to the Bragg-Williams and Bethe approximations, respectively. Work on the Cu-Au system indicates that at least a tetrahedron approximation is required for fcc-based systems; apparently, tetrahedron correlations are needed to account for the frustration effect. The $CaCO_3$ - $MgCO_3$ system was successfully treated as a trigonally distorted fcc-based system, in an anisotropic tetrahedron approximation. The Fe_2O_3 - $FeTiO_3$ system, was treated as a derivative of the simple hexagonal lattice in which permanent vacant sites occupy 1/3 of the lattice sites; a triangular prism was used as the basic cluster. Although the CVM was originally developed to study alloy systems, it yields quite reasonable results for these more complicated mineral/ceramic systems.

800,946

PB89-126825

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Crack Resistance by Interfacial Bridging: Its Role in Determining Strength Characteristics.

Final rept.,

R. F. Cook, C. J. Fairbanks, B. R. Lawn, and Y. W. Mai. 1987, 12p

Sponsored by Army Research Office, Research Triangle Park, NC.

Pub. in *Jnl. of Materials Research* 2, n3 p345-356 May/June 87.

Keywords: *Crack propagation, *Ceramics, *Grain boundaries, Indentation, Mechanical tests, Stress amplitude, Microstructure, Loads(Forces), Toughness, Fracture strength, Glass, Aluminum oxide, Barium titanates, Defects, Interfaces, Reprints.

An indentation-strength formulation is presented for nontransforming ceramic materials which show an increasing toughness with crack length (T -curve, or R -curve) due to the restraining action of interfacial bridges behind the crack tip. By assuming a stress-separation function for the bridges a microstructure-associated stress intensity factor is determined for the penny-like indentation cracks. This stress intensity factor opposes that associated with the applied loading, thereby contributing to an apparent toughening of the material, i.e., the measured toughness is excess of that associated with the intrinsic cohesion of the grain boundaries (intergranular fracture). The incorporation of this additional factor into conventional indentation fracture mechanics allows the strengths of specimens with Vickers flaws to be calculated as a function of indentation load. The resulting formulation is used to analyze earlier indentation strength data on a range of alumina, glass-ceramic and barium titanate materials. Numerical deconvolution of these data determines the appropriate T -curves. A feature of the analysis is that materials with pronounced T -curves have the qualities of flaw tolerance and enhanced crack stability.

800,947

PB89-127146

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Precise Determination of Aluminum by Instrumental Neutron Activation.

Final rept.,

R. F. Fleming, and R. M. Lindstrom. 1987, 8p

Pub. in *Jnl. of Radioanalytical and Nuclear Chemistry* 113, n1 p35-42 1987.

Keywords: *Radioactivation analysis, *Aluminum, *Fly ash, Single crystals, Sapphire, Neutron counters, Irradiation, Counting, Precision, Reprints.

Because of the short half life (2.3 min) of Al^{28} , the determination of aluminum by neutron activation is subject to many inaccuracies: variation of irradiation conditions between sample and standard, uncertainties in timing, and the effects of high and varying count rate. These errors can all be made smaller than the fundamental limit set by counting statistics. The transfer function from the observed number of net counts to the counting rate at the end of irradiation is modeled as a product of three processes: radioactive decay and extending and nonextending dead time. The procedure has been applied to the analysis of NBS SRM 1633a Fly Ash. The mean concentration measured was 14.085 %Al, with a standard deviation of the mean 0.023 %Al for four determinations. The final results showed no significant imprecision beyond counting statistics. The accuracy of the method is shown by the analysis of high-purity single-crystal sapphire.

800,948

PB89-132823

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Application of Wavelength-Dispersive Digital Compositional Mapping to High-Temperature Superconductors.

Final rept.,

R. B. Marinenko, D. E. Newbury, D. S. Bright, R. L. Myklebust, and J. E. Blendell. 1988, 4p

Pub. in *Microbeam Analysis* - 1988, p37-40.

Keywords: *Ceramics, *Superconductors, *Microstructure, *Processing, *X-ray analysis, High temperature tests, Compositions, Mapping, Wave dispersion, Barium oxides, Yttrium oxides, Copper oxides, Reprints.

The new high- T (sub c) superconductors are advanced ceramic materials prepared from oxide powders which are pressed and sintered. Their physical properties depend on the microstructure, which in turn depends strongly on the processing sequence used in their production. Wave-length-dispersive (WDS) x-ray compositional mapping was used to study the microstructure of the $Ba(sub 2)YCu(sub 3)O(sub 6+x)$ ceramics being produced at the National Bureau of Standards so as to understand better the processing procedures and the resulting physical properties.

800,949

PB89-133573

PC A03/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Standard Reference Materials: Preparation and Certification of SRM-2530, Ellipsometric Parameters Delta and Psi and Derived Thickness and Refractive Index of a Silicon Dioxide Layer on Silicon.

Special pub. (Final),

G. A. Candela, D. Chandler-Horowitz, J. F.

Marchiando, D. B. Novotny, B. J. Belzer, and M. C.

Croarkin. Oct 88, 50p NIST/SP-260/109

Also available from Supt. of Docs. as SN003-003-02908-4. Library of Congress catalog card no. 88-600591.

Keywords: *Accuracy, *Standards, *Ellipsometers, *Silicon dioxide, *Layers, *Refractivity, Thickness, Substrates, Mathematical models, Equations, Calibrating, Measurement.

A Standard Reference Material, SRM-2530, has been designed, fabricated, and certified for the ellipsometric parameters delta and psi, and for the derived thickness and refractive index of a silicon dioxide layer on silicon using a highly accurate ellipsometer built at NIST. The SRM is issued primarily to evaluate the accuracy of ellipsometers. The SRM consists of a 76-mm (three-inch) diameter silicon wafer with a silicon dioxide layer of one of three uniform thicknesses, 50, 100, or 200 nm. The design and fabrication of the SRM are presented along with the ellipsometric technique and data analysis leading to certification of the SRM. A least-squares method minimizing the sum of squares of deviations in delta and psi between the measured values and those calculated from a model has been

used in certifying the SRM. The two-layer modeling analysis gives better agreement to the collective multiple sample ellipsometric measurement data than does the one-layer modeling analysis, and gives a value for the refractive index of the silicon dioxide layer that is independent of thickness. Therefore, the certified values of thickness and refractive index are based on the two-layer model.

800,950

PB89-148332

PC A10/MF A01

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.

Design and Construction of a State-of-the-Art High Temperature Tribometer.

Special pub. (Final),

J. P. Yellefs, S. M. Hsu, and E. E. Klaus. Sep 88, 215p NIST/SP-755

Also available from Supt. of Docs as SN003-003-02913-1. Library of Congress catalog card no. 88-600579. Prepared in cooperation with Pennsylvania State Univ., University Park. Dept. of Chemical Engineering.

Keywords: *High temperature tests, *Ceramics, Design criteria, Construction, Wear resistance, Reviews, Tools, Diesel engines, Gas turbines, Stirling cycle engines, Spacecraft, Marketing, Foreign trade, *Tribometers, Tribotechnology.

High temperature ceramic tribology is one of the fastest growing and least understood areas in tribology. The need to understand the mechanisms of friction and wear for ceramic materials is critical. Ceramic materials are being utilized to tool development, bearing design, materials development for low-heat-rejection diesels, automotive gas turbines, Stirling engines, and aerospace applications. The development of a ceramics industry capable of manufacturing high technology wear resistant ceramics is essential in the United States, or the United States will lose a substantial market to an already rapidly growing foreign market.

800,951

PB89-148340

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

High-Temperature Superconductivity: Abstracts of NIST (National Institute of Standards and Technology) Publications, 1987-1988.

Special pub. (Final),

M. E. DeWeese, R. A. Kamper, and R. M. Powell. Nov 88, 37p NIST/SP-759

Also available from Supt. of Docs as SN003-003-02902-5. Library of Congress catalog card no. 88-600602.

Keywords: *Ceramics, *Superconductivity, *Abstracts, Standards, Superconductors, Thallium, Yttrium, High temperature tests, Bismuth, Electromagnetic field, Electric contacts, X ray diffraction, Crystal defects, Phase transformations, Thin films.

The authors have collected abstracts from 61 papers published between March 1987 and May 1988 covering various aspects of superconductivity research. The work of nine divisions of the National Institute of Standards and Technology (formerly the National Bureau of Standards) in both Boulder, Colorado, and Gaithersburg, Maryland, is represented.

800,952

PB89-148357

PC A11/MF A01

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.

Ceramic Tribology: Methodology and Mechanisms of Alumina Wear.

Special pub. (Final),

R. S. Gates, S. M. Hsu, and E. E. Klaus. Sep 88, 231p NIST/SP-758

Also available from Supt. of Docs as SN003-003-02914-9. Library of Congress catalog card no. 88-600582. Prepared in cooperation with Pennsylvania State Univ., University Park. Dept. of Chemical Engineering.

Keywords: *Ceramics, *Lubricants, Aluminum oxide, Wear resistance, Friction, Wear tests, X ray diffraction, Reaction kinetics, Water, Stresses, Aluminum hydroxides, Phase transformation, Thermogravimetry, Performance evaluation, Photomicrograph, Bonding, Tables(Data), *Tribology, Four ball tests.

The report describes a systematic study that has been conducted to develop methods for measuring the tri-

biological properties of ceramic materials under concentrated contacts. Step-loading four-ball and ball-on-three-flat wear tests were developed to provide friction and wear characteristics of ceramic/lubricant combinations under various lubrication conditions. These measurement techniques now enable one to study the effect of different materials processing parameters, material microstructures, and different lubricants on the friction and wear performance of ceramics. Water was found to react with alumina in a wearing contact to produce lubricious products. A combination of x-ray diffraction and thermogravimetric analysis techniques were used to investigate the kinetics of alumina-water reactions.

Coatings, Colorants, & Finishes

800,953
PATENT-4 772 370 Not available NTIS
Department of Commerce, Washington, DC.
Process for Producing Icosahedral Materials.
Patent,
K. G. Kreider. Filed 23 Jun 87, patented 20 Sep 88, 16p PB89-114565, PAT-APPL-7-065 530
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

Keywords: Patents, *Metal films, Crystallinity, Vapor deposition, *Sputtering, X ray diffraction, Icosahedrons, Manganese, Aluminum, Glass, Alloys, Quasi crystalline.

A method for producing quasi-crystalline films by direct vapor deposition through sputtering is provided. The method is applicable to all alloys which can be converted to quasi-crystalline structure by melt spinning.

800,954
PB88-175518 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Characterization of Epoxy Coatings on Steel by Reflection/Absorption Fourier Transform Infrared Spectroscopy. 1. Effects of Film Thickness and Angle of Incidence.
Final rept.,
T. Nguyen, E. Byrd, and A. Tsao. 1986, 14p
Pub. in Jnl. of Applied Polymer Science 32, n8 p6339-6352 1986.

Keywords: *Steels, *Cold rolling, Epoxy coatings, Non-destructive tests, Reprints, Fourier transform infrared spectroscopy.

The effects of film thickness and angle of incidence on reflection/absorption Fourier transform infrared (FTIR-RA) spectral characteristics of epoxy films on cold-rolled steel are reported in the paper. Comparing to transmission spectra, RA spectra of epoxy coatings on metal show band shifts and distortions at several strongly absorbed bands of both thin and thick films. FTIR-RA spectra at different film thicknesses suggest that some of these shifts and distortions are due to the dispersivity of the refractive index of the films. In addition, phase shifts between the incoming and reflected beams, front surface reflectivity, interference fringe and optical cavities may also contribute to band distortions of both thin and thick films.

800,955
PB88-175542 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Predicting Service Life of Protective Coatings Using Reliability Theory.
Final rept.,
M. E. McKnight, J. W. Martin, and L. W. Masters. 1985, 8p
Pub. in Jnl. of Protective Coatings and Linings 2, n7 p18-25 Jul 85.

Keywords: *Protective coatings, *Service life, Organic coatings, Reliability, Accelerated tests, Reprints.

The approach to service life prediction of organic coatings based on reliability theory and life testing analysis techniques is contrasted with the traditional correlative approach. Reliability theory and life testing analysis techniques provide a systematic approach for quantitative prediction of service life from accelerated testing

data. By performing tests at several levels of degradation factors or stress, transformation equations are determined so that performance at low levels of stress can be calculated from performance at high levels of stress. In addition, the systematic approach permits quantitative estimates of early failure times and contributes to improved understanding of degradation mechanisms and assessment of degradation factors. Results of applying the approach for predicting the service life of an acrylic and alkyd coating system on steel at low temperatures from service life at higher temperatures at high relative humidities are included.

800,956
PB88-230578 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Electrodeposited Cu-Ni Textured Superlattices.
Final rept.,
D. S. Lashmore, and M. P. Dariel. 1988, 4p
Pub. in Jnl. of the Electrochemical Society: Solid-State Science and Technology 135, n5 p1218-1221 May 88.

Keywords: *Electrodeposition, Substrates, X ray diffraction, X ray analysis, Coatings, Epitaxy, Reprints, *Copper nickel alloys, Superlattices.

Artificially layered materials of alternating 2-3 nm thick copper and nickel layers have been produced by electrodeposition on oriented single-crystal copper substrates. X-ray diffraction examination of thin layers chemically removed from the substrate showed that a coherent, relatively homogeneous coating, with a strong epitaxial relationship, had been produced. In particular, artificially layered Cu-Ni alloys displaying a textured (110) orientation were obtained by electrodeposition. Noncoherent nucleation leads to the presence of various amounts of randomly oriented alloy grains on all substrates but, in particular, for the (100) orientation.

800,957
PB89-107205 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Argon Sputtering Analysis of the Growing Surface of Hydrogenated Amorphous Silicon Films.
Final rept.,
G. H. Lin, J. R. Doyle, M. He, and A. Gallagher. 1988, 7p
Sponsored by Solar Energy Research Inst., Golden, CO.
Pub. in Jnl. of Applied Physics 64, n1 p188-194, 1 Jul 88.

Keywords: *Silicon hydrides, Argon, Sputtering, *Films, Coatings, *Surface chemistry, Microstructure, Reprints.

The surface of freshly deposited hydrogenated amorphous silicon (a-Si:H) films are studied by argon sputtering and mass-spectrometer detection of the sputtered neutral molecules. The surface density of H atoms in the top H-rich layers of the film is established from the initial surge of sputtered H-containing molecules. This shows that the growing film has a hydrogen-rich surface layer of multiply H bonded Si atoms about five monolayers thick on a room-temperature substrate. At the approximate 240 deg C substrate temperature typical of film production, the thickness of the hydrogen-rich layer decreases to about one monolayer.

800,958
PB89-119077 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Electroformed Microhardness Standards.
Final rept.,
D. R. Kelley, D. S. Lashmore, and C. E. Johnson. 1984, 4p
Pub. in Mechanical Properties, Performance and Failure Mode's of Coatings, v37 p55-58 May 84.

Keywords: *Hardness tests, *Microhardness, Knoop hardness, Electroplating, Engineering standards, Non-destructive tests, Loads(Forces), Reprints.

Electroplating technology was utilized to fabricate new microhardness standard reference materials. The technology provides a means for obtaining uniform hardness by close control of various process variables which determine uniform grain structure and composition. Two microhardness standards are now in production; one with a hardness of about 125 kg/mm sup 2, and the second at about 600 kg/mm sup 2. The hard-

ness values are certified at loads of 0.245, 0.490, and 0.981 Newtons (25, 50, and 100 gram-force) with both Vickers and Knoop indentors. These electroplated materials have standard deviation in hardness, particularly at low loads, significantly better than current commercially available standards. The fabrication of the new standards, their certification procedures, and testing machines will be discussed.

800,959
PB89-119259 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Prediction of the Service Life of Organic Coatings on Steel. Part 3. Categorizing the Performance of Coating Systems on the Basis of Their Corrosion and Blister Patterns.
Final rept.,
J. W. Martin, and M. E. McKnight. 1985, 7p
See also Part 2, PB86-186780.
Pub. in Jnl. of Coatings Technology 57, n724 p49-55 1985.

Keywords: *Coatings, *Defects, *Acrylic resins, *Alkyd resins, Orientation, Clustering, Spatial distribution, Area, Clumps, Scaling, Reprints.

The spatial pattern of the defects resulting from the aging of coating systems and the scale of clustering of these defects are quantitatively determined in a laboratory experiment for an acrylic and an alkyd coating system. For the acrylic, it is established that defects are randomly distributed over the surface of the panels, whereas for the alkyd, the defects are randomly distributed over the surface of the panels, whereas for the alkyd, the defects are clustered. Clustered defects can be further described by the surface area on the panels circumscribed by the defects. For the alkyd coating system, two scales of clustering appear to be operating. The first scale occurs at a surface area between 8 and 16 cm sup 2 and is believed to describe the area circumscribed by individual defects. The second scale occurs at a surface area greater than 96 cm sup 2 and is believed to describe the area circumscribed by the individual clusters. Knowledge of the scale of clustering should be useful in identifying the causes and mechanisms of coating failure. It is concluded that spatial techniques should prove to be valuable in categorizing the degradation of different coating systems and in helping to isolate the causes and mechanisms of coating degradation.

Composite Materials

800,960
PB88-164033 PC A03/MF A01
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Application of Optical Image Analysis to Quantitative Microstructure Characterization of Composite Materials.
J. F. Kelly. Dec 87, 18p NBSIR-87/3681
Sponsored by Army Materials Technology Lab., Watertown, MA.

Keywords: *Composite materials, *Mechanical properties, Ceramics, Microstructure, *Graphite reinforced composites.

The ultimate objective of the project is to define standard procedures for numeric description, by image analysis (optical and SEM), of the microstructural features relevant to mechanical properties of organic matrix composites and advanced structural ceramic materials. The effort in this initial year of the project at NBS concentrated on two aspects of image analysis characterization: the system calibration procedure to satisfy accuracy and precision requirements, and the specific details of a microstructural analysis applied to a single composite specimen. For this work, AMTL provided a calibration test slide containing a number of geometric figures of specified dimensions and a prepared composite specimen of unidirectional graphite fiber reinforced polymer.

800,961
PB88-177613 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

MATERIALS SCIENCES

Composite Materials

Technique for Measuring Stresses Which Occur during Sintering of a Fiber-Reinforced Ceramic Composite.

Final rept.,
C. Ostertag. 1987, 3p
Pub. in Jnl. of the American Ceramic Society 70, n12
pC-355-C-357 Dec 87.

Keywords: *Composites, Reprints, *Fiber reinforced, *Sintering, Stresses, Temperature dependence, Technique.

A new technique for monitoring stresses during sintering of a ceramic composite has been developed. The stress is measured by means of the heterogeneity stresses that build up in a sandwich compact, which consists of a layer, or plane, of SiC fibers between two layers of ceramic powder of different thicknesses. Upon sintering, this configuration produces an asymmetric stress field across the thickness of the specimen, which results in the bending of the compact, as characterized by the curvature of the fibers. In situ observations of the process provide information about the temperature dependence of stress initiation.

800,962

PB88-193347 PC A06/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.

Standard Reference Materials: Portland Cement Chemical Composition Standards (Blending, Packaging, and Testing).

Special pub. (Final),
R. K. Kirby, and H. M. Kanare. Feb 88, 103p NBS/SP-260/110

Also available from Supt. of Docs. Library of Congress catalog card no. 88-600503. Prepared in cooperation with Portland Cement Association, Skokie, IL. Construction Technology Labs.

Keywords: *Portland cements, Chemical composition, Standards, Evaluation, Calibrating, Blending, Packaging, Homogeneity, Tests.

Standard Reference Materials (SRMs) of portland cement are intended for use in evaluating chemical methods of analysis and in calibrating instrumental methods of analysis such as x-ray fluorescence and atomic absorption spectroscopy. The first cement SRMs, numbers 177, 1011, 1013, 1014, 1015, and 1016, are no longer in stock. SRMs 633, 634, 635, 636, 637, 638, 639, 1880, and 1881 have been produced to replace the first series. The paper describes the blending, packaging, homogeneity testing, and the detailed analysis of the chemical composition for the certification of SRMs 633-639 and 1880 and 1881.

800,963

PB88-194980 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Conductive Composites.

Final rept.,
D. E. Hall. 1988, 49p
Pub. in Encyclopedia of Composites, v1 p1-49 1988.

Keywords: *Composite materials, Carbon black, Graphite, Polymers, Electromagnetic interference, Electromagnetic shielding, Electrical conductivity.

Conductive composites are made by adding a sufficient quantity of an electrically dispersed phase to a polymeric resin. The chapter presents an overview of the current status of conductive composites. The principles of electrical conduction in composites are related to percolation theory, and the influence of materials properties and interactions on conductivity are discussed. The conductive fillers, matrix resins, and other composite constituents are described. Special requirements for compounding and molding are discussed, as are aspects of environmentally-induced degradation unique to conductive composites. The chapter concludes with a survey of the many applications of conductive composites, including several that have already been commercialized.

800,964

PB88-197132 PC A10/MF A01
National Bureau of Standards (IMSE), Gaithersburg, MD.

Composite Materials Interface Characterization,

H. N. G. Wadley, J. A. Simmons, R. B. Clough, F. Biancanello, and E. Drescher-Krasicka. Mar 88, 224p NBSIR-87/3630

See also PB82-152414.

Keywords: *Composite materials, *Interfaces, Surface properties, Ultrasonic frequencies, Acoustic emissions, Fiber reinforced composites.

Interfaces and interface zones in composites are studied using ultrasonic and acoustic emission techniques on models of single reinforcing elements in a matrix. The theory of ultrasonic scattering and guided interface waves is developed for a model composite with a planar, cylindrical or spherical interface zone with visco-elastic properties varying in a direction perpendicular to the interface zone. Experimental confirmation was carried out for both the planar and cylindrical geometries with a perfect interface. Both Stoneley and leaky waves were detected on the planar geometry for a Steel-Ti system. By using specially designed specimens of SiC fibers in aluminum, acoustic emission and tensile testing permitted determination of fiber and interface strengths as well as adhesive energy and fracture toughness. The results show that interface mechanical properties are sensitive to processing variables. Acoustic emission provides an effective technique for discriminating between failure mode types such as fiber fracture or delamination.

800,965

PB88-201553 PC A04/MF A01
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Thermal Conductivity of Selected Foams and Systems from 100 to 300 K.

Final rept. May-Jul 86,
L. L. Sparks, W. P. Dube, and A. J. Slifka. Jan 88, 56p NBSIR-88/3086

Keywords: *Urethanes, *Thermal conductivity, *Foam, Low temperature, Polyurethane foam, Gaseous diffusion, Polymethacrylimide.

The apparent thermal conductivity of five insulating materials was determined in the nominal temperature range from 100 to 300 K (-280 to 80 deg F). A guarded-hot-plate apparatus was used and the testing environment was dry nitrogen gas at near ambient pressure. One specimen was retested in a vacuum environment. Three of the specimens were neat polymethacrylimide (PMA) foams with nominal densities of 51 and 71 kg/cu. m. (3.2 and 4.4 lb/cu. ft.). Other specimens tested were a polyurethane foam sprayed on an aluminum substrate and a sandwich construction specimen utilizing PMA foam of nominal density 110 kg/cu. m. (6.9 lb cu. ft.). The results in nitrogen gas show the expected conductivity increase with increasing density. The observed conductivity at 0.67 Pa (5 micrometers of Hg) is significantly lower than that in ambient-pressure nitrogen gas. The large relative difference may be due to increased thermal resistance at the plate-specimen boundaries.

800,966

PB88-215488 PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

Evaluation of Test Methods for Measuring the Bond Strength of Portland-Cement Based Repair Materials to Concrete.

L. I. Knab, and C. B. Spring. Apr 88, 47p NBSIR-88/3746
Sponsored by Corps of Engineers, Washington, DC., Naval Facilities Engineering Command, Alexandria, VA., and Air Force Engineering and Services Center, Tyndall AFB, FL.

Keywords: *Portland cements, *Concrete, Test methods, Evaluation, *Bond strength, *Repair materials.

Three bond strength test methods were evaluated for screening and selecting repair materials used in overlaying and patching portland cement concrete. Bond strengths of three repair materials to base concrete were investigated using two uniaxial tensile bond strength test methods and a slant shear bond strength test method. The differing strengths of the repair materials caused different failure patterns, which had to be considered in the analyses of the failure stresses. Substantial differences in the failure stresses of the uniaxial tension and slant shear test methods were attributed to their different geometries and loading conditions. These differences emphasized the need to select test method(s) with geometry and loading conditions which are anticipated for the in-service repair material. For the two higher strength repair materials investigated, the relative precision (repeatability) of the slant shear and one of the uniaxial tensile test methods (pipe nipple grips) were comparable and relatively good (coefficient of variation values were about 5%).

800,967

PB88-232863 PC A04/MF A01
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Mechanical Property Enhancement in Ceramic Matrix Composites.

Interim rept.,
S. W. Freiman, T. W. Coyle, E. R. Fuller, P. L. Swanson, D. C. Cranmer, and W. Haller. Apr 88, 60p NBSIR-88/3798
Contract N00014-86-F-0096

Prepared in cooperation with Drexel Univ., Philadelphia, PA. Dept. of Materials Engineering. Sponsored by Office of Naval Research, Arlington, VA.

Keywords: *Glass fibers, *Ceramics, *Fractography, Curing, Mechanical properties, Strength of materials, Cracking, Interfacial tension, *Ceramic matrix composites, Boron fibers, Borosilicates.

The interfacial strength between AVCO SCS-6 filaments and a borosilicate glass matrix was measured using an indentation push-in technique. Crack-filament interactions were investigated using a fracture mechanics technique (DCDC). An ultraviolet curing technique, coupled with hot pressing was developed to prepare SiC filament-borosilicate glass composites.

800,968

PB88-241880 PC A03/MF A01
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Fibrous Alumina-Silica Insulation Board as a Candidate Standard Reference Material of Thermal Resistance.

J. G. Hust, and D. R. Smith. Jun 88, 34p NBSIR-88/3094
Sponsored by Oak Ridge National Lab., TN.

Keywords: *Thermal resistance, *Standards, *Aluminum oxide, *Silicon dioxide, *Insulating boards, Thermal conductivity, Thermal insulation, Density(Number/volume), Pressure, Standard reference materials.

Measurements of apparent thermal conductivity are reported in order to provide the basis for certifying fibrous alumina-silica insulation board as a Standard Reference Material (SRM) of thermal resistance. These data encompass ranges of temperature from 93 to 746 K, densities from 207 to 308 kg/cu m3, and fill-gas pressures from roughing-pump vacuum to atmospheric pressure, in environments of both air and helium. Detailed analyses and intercomparisons of previously published data are given.

800,969

PB89-132989 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Role of Polymer Toughness in Matrix Dominated Composite Fracture.

Final rept.,
D. L. Hunston, and R. Dehl. 1987, 23p
Pub. in Proceedings of Conference on AUTOCOM '87, Dearborn, MI., June 1-4, 1987, p355-1-355-23.

Keywords: *Reinforced plastics, *Thermoplastic resins, *Composite materials, *Fracture, *Toughness, Polymers, Cantilever beams, Brittleness, Motor vehicles, Crack propagation, Fibers, Breaking, Bonding, Reviews.

Based on experimental and a review of literature data, the Mode I fracture energies for a wide range of polymers have been correlated with the interlaminar fracture energies of their composites as measured with the double cantilever beam test. For brittle polymers, increasing the resin toughness had a direct benefit in the composite interlaminar fracture energy; with tough polymers, an increase in resin toughness had only a modest impact on the composite behavior. Fiber pull-out and breakage increased the resistance to crack growth in the composite, while very poor fiber-matrix bonding (often present in thermoplastic composites) appears to decrease the interlaminar fracture energy.

Corrosion & Corrosion Inhibition

800,970

PB88-174149 Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

New Approach to Improving Resistance to Transgranular Stress Corrosion Cracking.

Final rept.,
M. J. Kaufman, and E. N. Pugh. 1986, 12p
Pub. in Proceedings of Conference on Critical Issues in Reducing the Corrosion of Steels, Nikko, Japan, March 11-13, 1985, p250-261 1986.

Keywords: *Austenitic steels, *Stress corrosion, Cracking(Fracturing), Shear strength, Reprints.

An approach is described which is based on the view that transgranular SCC occurs by discontinuous cleavage and that resistance to the form of cracking can be achieved by impeding the formation of steps between parallel but displaced cleavage facets. It is suggested that the steps in the case of susceptible FCC alloys are produced by plastic shearing on slip planes, and that the low energy process can be restricted either by ensuring that ready cross-slip can occur (by avoiding low stacking fault energy and short range order) or by increasing the shear strength by precipitation hardening. The approach is considered in terms of the literature on the chloride cracking of the austenitic stainless steels.

800,971
PB88-174198 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Progress Towards Understanding the Stress Corrosion Problem.

Final rept.,
E. N. Pugh. 1985, 10p
Pub. in Corrosion 41, n9 p517-526 Sep 85.

Keywords: *Stress corrosion, *Cracking(Fracturing), Alloys, Reprints.

The paper describes current understanding of the propagation of transgranular stress corrosion cracks in engineering alloys. In contrast to intergranular SCC which proceeds by preferential anodic dissolution at the crack tip, the transgranular form is considered to propagate by discontinuous brittle fracture (cleavage). The propagation process is first described, outlining the knowledge of the crystallography of the cleavage surfaces and reviewing the evidence for discontinuous nature of cracking.

800,972
PB88-193792 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

NACE-NBS (National Association of Corrosion Engineers-National Bureau of Standards) Corrosion Data Program.

Final rept.,
G. M. Ugiansky, A. C. Van Orden, and D. E. Clausen. 1986, 6p
See also PB88-193800.
Pub. in Proceedings of Conference on Corrosion '86, Houston, TX., March 17-21, 1986, 6p.

Keywords: *Corrosion, Corrosion prevention, Corrosion Data Center, Computer applications.

The Corrosion Data Program at NBS addresses the need for evaluated corrosion data and its effective dissemination. The Corrosion Data Center at NBS is dedicated to using computers in data collection, evaluation and dissemination. Examples are shown of how some of the outstanding capabilities of computers and computer graphics can be used to provide easy access to evaluated corrosion data. This provides the potential for helping to solve some of the most pressing needs in corrosion data and lowering the overall cost to the economy of corrosion.

800,973
PB88-193800 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

NACE-NBS (National Association of Corrosion Engineers-National Bureau of Standards) Corrosion Data Program: An Answer to the High Cost of Corrosion.

Final rept.,
D. C. Clausen, G. M. Ugiansky, and A. C. Van Orden. 1985, 7p
See also PB88-193792.
Pub. in Proceedings of Asian-Pacific Corrosion Control Conference: Material Conservation and Corrosion Control (4th), Tokyo, Japan, May 26-31, 1985, p1258-1264.

Keywords: *Corrosion, Corrosion prevention, Cost analysis, Corrosion Data Center.

Corrosion costs to the United States' economy are estimated to be \$168 Billion per annum (1984 Dollars). The costs to the world economy are proportionally higher. These costs can be reduced greatly through the application of presently known corrosion control methods and by the implementation of new, improved practices. This can be achieved through the accessibility to designers, engineers, and scientists of evaluated kinetic (rate) and thermodynamic (stability) corrosion data which are not now available. To provide these data, a central facility, the Corrosion Data Center, was established. The Center is the NBS component of a joint program between the National Association of Corrosion Engineers (NACE) and NBS; and it is concerned with the collection, evaluation, and effective dissemination of corrosion data. The central focus of the program is the establishment of an evaluated corrosion data base which can be easily computer accessed to provide the user with the required data in any of a number of possible graphical or tabular formats.

Elastomers

800,974
PB88-228176 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Fatigue of a Rubber Tank Track Compound under Tensile Loading.

Final rept.,
G. B. McKenna, G. W. Bullman, K. M. Flynn, and J. Patt. 1987, 10p
Pub. in Elastomers Rubber Technology, p525-534 1987.

Keywords: *Elastomers, *Fatigue(Materials), *Tanks(Combat vehicles), Military vehicles, Creep properties, Reprints.

Failure behavior of a carbon black filled rubber (15TP-14AX, MIL-T-11891) is being studied under uniaxial tensile testing conditions. Static and dynamic (fatigue) testing has been performed to study the material behavior within the context of a cycle shifted failure envelope model of rubber rupture. Results from testing of a standard filled butyl rubber formulation are presented for comparison. The results show that the behavior of the 15TP-14AX rubber, while showing a greater lifetime than the butyl rubber, is qualitatively similar. Failure times for both rubbers decrease with increasing frequency. Importantly, the number of cycles to failure increases with increasing test frequency. The failure lifetime of the rubbers can be related to the stress softening behavior under cyclic loading conditions. The authors have been able to predict failure lifetimes by using creep data obtained from short time cyclic loading histories and extrapolating to the strains at break determined from a shifted failure envelope.

800,975
PB89-126643 PC A03/MF A01
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymer Blends Group.
Small Angle X-ray Study of the Deformation of 4,4'-Diphenylmethane Diisocyanate/1,4'-Butanediol (MDI/BDO) Based Polyurethanes,
R. M. Briber, P. Sung, and J. D. Barnes. Oct 88, 30p
NISTIR-88/3873

Keywords: *Polyurethane resins, *Deformation, *X-ray analysis, Polymers, Morphology, Elongation, Crazing, Failure, Scattering, 4,4'-Diphenylmethane diisocyanate, 1,4'-Butanediol, Polytetramethylene oxide.

Small angle x-ray scattering (SAXS) has been used to study the effect of deformation on the hard segment domain morphology of a series of segmented polyurethanes based on MDI/BDO as the hard segment and PTMO as the soft segment. At relatively low elongations (100-200%) the hard segment lamellae orient and align with their long axis perpendicular to the deformation direction. As the deformation increases (200-400%) these aligned domains begin to break down and the SAX intensity decreases correspondingly. At the largest deformations (400-500%) a new component to the scattering appears as a streak running perpendicular to the deformation direction and subsequent optical microscopy revealed the presence of

crazes. Crazes have been observed at elongations close to failure in all three polyurethanes studied so far, yet the presence of crazing has not been recognized in the scientific literature as being important in understanding the deformation behavior of polyurethanes.

Iron & Iron Alloys

800,976
PB88-175062 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Improved Determination of Cobalt in Steel by X-ray Fluorescence Analysis.

Final rept.,
J. R. Sieber, and P. A. Pella. 1986, 2p
Pub. in X-Ray Spectrometry 15, n4 p287-288 1986.

Keywords: *Spectrochemical analysis, *Cobalt, *Steels, Chemical analysis, X ray fluorescence, X ray analysis, Reprints, Matrix isolation.

The report is on a method of improving the determination of cobalt as a minor element in steel specimens. The authors found that a line overlaps correction for the contribution of the Fe K-beta background on the Co K-alpha peak plus interelement matrix corrections are necessary to analyze Co when standards of varying matrix compositions are used. The authors have analyzed Co in several NBS-SRM steels and found values that agree with the certificate values to within 5% relative error in the range of 0.005 to 0.40 weight percent cobalt.

800,977
PB88-175526 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

Application of Reflection Absorption Fourier-Transform Infrared-Spectroscopy to Studies of the Degradation of Protective Coatings on Steel.

Final rept.,
T. Nguyen, and W. E. Byrd. 1987, 6p
Pub. in Jnl. of Coatings Technology 59, n748 p39-44 1987.

Keywords: *Steels, *Cold rolling, *Protective coatings, Nondestructive tests, Corrosion, Reprints, Fourier transform infrared spectroscopy.

Reflection/Absorption Fourier Transform Infrared Spectroscopy and its use as a nondestructive tool to characterize the degradation of protective coatings on cold-rolled steel surfaces subjected to a corrosive environment are presented in the paper. Under warm and moist conditions, the protective coatings weakened and dissociated the hydrogen bonds, and degraded in the main chains. The results showed that the method can be used to nondestructively characterize coatings and their interactions with the metal substrate, and to study chemical changes at the metal/coating interface resulting from corrosion.

800,978
PB88-175534 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

Thermal-Wave Imaging of the Microstructure and Corrosion of Cold-Rolled Steel under Protective Coatings.

Final rept.,
T. Nguyen. 1985, 5p
Pub. in Industrial and Engineering Chemistry, Product Research and Development 24, n4 p496-500 Dec 85.

Keywords: *Steels, *Cold rolling, Nondestructive tests, Corrosion prevention, Microscopy, Microstructure, Reprints.

The application of thermal-wave imaging as a nondestructive method to the studies of corrosion and microstructure of polished and rough cold-rolled steel under clear and opaque coatings is presented in the paper. Thermal-wave imaging is shown to clearly distinguish the corrosion products from the surface topographic features of steel substrate with or without a protective coating layer. Preliminary results also indicate that thermal-wave can image the microstructure of cold-rolled steel under a coating. The diffusion lengths of thermal-wave in corrosion products are in

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Iron & Iron Alloys

the range of 1 micrometers at 1.75 MHz and 7.5 micrometers at 79 kHz modulation frequency. The technique is thus potentially a viable technique to detect and assess very early corrosion of steel protected by clear and pigmented coatings.

800,979
PB88-190160 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Ultrasonic Measurement of Internal Temperature Distribution.
Final rept.,
H. N. G. Wadley, S. J. Norton, F. Mauer, and B. Droney. 1986, 20p
Pub. in Philosophical Transactions of the Royal Society of London A 320, n1554 p341-360 1986.

Keywords: *Steels, *Process control, *Temperature measurement, *Temperature measuring instruments, *Austenitic stainless steels, *Aluminum, *Reprints, *Tomography, *Ultrasonics.

Implementation of advanced materials processing strategies is presently hampered by a lack of adequate process control sensors. For the processing of basic materials such as steel and aluminum, an internal temperature distribution sensor is needed. For these metals the velocity of ultrasound is well known to be a strong function of temperature. The authors have therefore explored the feasibility of precisely measuring the velocity-temperature relation for a particular steel and then using this reference data to convert an ultrasonic velocity tomogram for a hot steel body to an internal temperature distribution. Initial experiments on austenitic steel samples of cylindrical and square cross section using noncontact ultrasonic techniques have shown that this approach yields acceptable temperature profiles.

800,980
PB88-194899 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Alloy 316LN for Low Temperature Structures: A Summary of Tensile and Fracture Data.
Final rept.,
R. P. Reed, N. J. Simon, P. T. Purtscher, and R. L. Tobler. 1986, 5p
Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of International Cryogenic Engineering Conference (11th), Berlin, West Germany, April 22-25, 1986, p786-790.

Keywords: *Austenitic stainless steels, *Superconducting magnets, *Fracture strength, *Tensile properties, *Steel 316LN.

For structural use in superconducting magnet applications, alloy 316LN offers higher strength than 304LN with equivalent toughness. Nitrogen additions permit one to obtain a range of yield strength levels with little added cost. Tensile and fracture toughness data at 4 K are presented for a variety of 316 and 316LN alloys. The specimens were obtained from suppliers in Japan, Europe, and the United States and were tested at NBS. Elastic-plastic fracture toughness was determined from J-integral measurements.

800,981
PB88-199013 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Design of 316LN-Type Alloys.
Final rept.,
N. J. Simon, and R. P. Reed. 1988, 8p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Advances in Cryogenic Engineering Materials, v34 p165-172 1988.

Keywords: *Austenitic stainless steels, *Superconducting magnets, *Fracture strength, *Tensile properties, *Yield strength, *Cryogenics.

For structural use in 4-K superconducting magnet applications, alloy 316LN offers higher strength than 304LN with equivalent toughness. Nitrogen additions permit the attainment of high yield strengths with little added cost. To achieve high yield strength with high fracture toughness at 4 K, careful consideration of alloy design parameters is necessary. Regression analysis for significant design parameters has been carried out on a matrix of 99 recent NBS measurements at 4 K on a variety of 316, 316LN, and 316LHN alloys obtained from suppliers in Japan, Europe, and

the United States. The data matrix includes more extensive numerical data on alloying, refining, and processing parameters than have previously been available.

800,982
PB88-199021 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Molybdenum Effect on Fe-Cr-Ni-Alloy Elastic Constants.
Final rept.,
H. M. Ledbetter, and S. A. Kim. 1988, 5p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Jnl. Mater. Res. 3, n1 p40-44 Jan/Feb 88.

Keywords: *Iron alloys, *Elastic properties, *Chromium containing alloys, *Nickel containing alloys, *Molybdenum containing alloys, *Bulk modulus, *Modulus of elasticity, *Shear modulus, *Face centered cubic lattices, *Reprints.

The study involved the ultrasonic measurement of the polycrystalline elastic constants of six face-centered-cubic Fe-Cr-Ni alloys, nominally Fe-19Cr-12Ni (at. %). In these alloys, Mo content ranged up to 2.4 at. %. Molybdenum lowers the Young and shear moduli, and it raises the Poisson ratio. Against expectation (because it increases volume), Mo raises the bulk modulus. Qualitatively, the results show that Ni raises the bulk modulus and Poisson ratio; but Ni lowers the Young and shear moduli. (Nickel decreases the alloy's atomic volume.) The discussion includes existing models based on 3d-electron theory.

800,983
PB88-216601 PC A10/MF A01
National Bureau of Standards, Gaithersburg, MD.
Investigation into the Ashland Oil Storage Tank Collapse on January 2, 1988.
J. L. Gross, F. Y. Yokel, R. N. Wright, A. H. Fanney, J. H. Smith, G. E. Hicho, and T. R. Shives. Jun 88, 202p NBSIR-88/3792

Keywords: *Pennsylvania, *Oil storage, *Collapse, *Steels, *Investigations, *Brittleness, *Fracture (Materials), *Storage tanks, *Fracture strength, *Ashland Petroleum Company.

On January 2, 1988, a four million gallon capacity oil storage tank at the Ashland Petroleum Company Floreffe Terminal near West Elizabeth, Pennsylvania, collapsed as it was being filled to capacity for the first time since it was reconstructed at the site. The tank had been dismantled in Cleveland, Ohio, after more than 40 years of service and reconstructed at the Floreffe site in 1986. The National Bureau of Standards (NBS) conducted an independent investigation of the physical causes of the Ashland Tank collapse. Data were obtained from NBS field observations, laboratory and analytical studies, from the investigation of the Pennsylvania Tank Collapse Task Force appointed by the Governor of Pennsylvania, and from the Battelle Columbus Division investigation sponsored by the Ashland Petroleum Company. The cause of the failure was determined to be brittle fracture, initiating from a flaw existing prior to the reconstruction of the tank.

800,984
PB89-101661 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
High-Energy-Beam Welding of Type 316LN Stainless Steel for Cryogenic Applications.
Final rept.,
T. A. Siewert, D. Gorni, and G. Kohn. 1988, 8p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Advances in Cryogenic Engineering Materials, v34 p343-350 1988.

Keywords: *Stainless steel, *Cryogenics, *Electron beam welding, *Laser welding, *Mechanical properties, *Fracture tests, *Cracking (Fracturing), *Reprints.

Laser and electron-beam welds in 25-mm-thick type 316LN stainless steel containing 0.16 wt. percent N were evaluated. Their mechanical properties are compared with those of welds produced with more conventional, lower productivity processes, such as shielded-metal-arc and gas-metal-arc welding. Because these welds are so narrow (about 2 mm), tensile tests were performed on transverse tensile specimens at 4 K. For both welding processes, the fractures occurred in the base metal at a strength level near 950 MPa, indicating

that the weld and heat-affected zone has a strength similar to that of the base metal. The 4-K weld fracture toughness averaged near 150 MPa/m for both welding processes, a value only slightly less than that for the base metal and comparable to the best values achieved with conventional welding processes using type 316LN weld metal of similar strength. The Charpy V-notch absorbed energies averaged near 70 J at 76 K. Metallographic analysis revealed cellular, fully austenitic solidification with little porosity and no evidence of hot cracking.

800,985
PB89-118970 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Low-Temperature Manganese Contributions to the Elastic Constants of Face-Centered-Cubic Fe-Cr-Ni Stainless Steel.
Final rept.,
H. M. Ledbetter, and S. A. Kim. 1988, 4p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Jnl. of Materials Science 23, p2129-2132 1988.

Keywords: *Chromium steels, *Manganese steels, *Ultrasonic tests, *Modulus of elasticity, *Nickel steels, *Low temperature tests, *Elastic properties, *Shear modulus, *Magnetic tests, *Nondestructive tests, *Transition temperature, *Reprints.

By ultrasonic methods, the elastic constants between 295 and 4 K of nominally Fe-18Cr-8Ni alloys (in wt%) containing up to 6% manganese were determined. The authors report five elastic constants: C_{11} = longitudinal modulus, B = bulk modulus, E = Young modulus, G = shear modulus, and ν = Poisson ratio. At all temperatures, manganese lowers all these elastic constants. With the exception of ν , larger reductions occur at 4 K than 295 K. At 4 K, the bulk modulus decreases more than the shear modulus: approximately 0.54 and 0.30% per percent manganese, respectively. Manganese raises the magnetic-transition temperature, which occurs between 40 and 90 K, by approximately 9 K per percent manganese. A simple model predicts the volume increase accompanying Mn alloying. However, a simple model fails to predict the elastic-constant reductions; this suggests magnetic interatomic interactions.

800,986
PB89-123301 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Mechanical Tests of Large Specimens at 4 K: Facilities and Results.
Final rept.,
K. Yoshida, H. Nakajima, M. Oshikiri, R. L. Tobler, and S. Shimamoto. 1988, 8p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Advances in Cryogenic Engineering Materials, v34 p225-232 1988.

Keywords: *Tensile testers, *Cryogenics, *Austenitic stainless steels, *Cracking (Fracturing), *Forgings, *Hot-rolling, *Metal plates, *Hydraulic equipment, *Fatigue (Materials), *Samples, *Size determination, *Reprints.

Mechanical tests of large specimens were performed using a hundred-metric-ton cryogenic hydraulic tensile test machine at the Japan Atomic Energy Research Institute's Naka Fusion Research Establishment. The test specimens were machined from a 140-mm forged steel plate and from a 100-mm hot-rolled steel plate. In 4 K tensile tests, data for a 25-mm-diameter round specimen were obtained and compared with data for a standard 7-mm-diameter specimen. In 4 K fracture tests, data for a 100-mm-thick compact tension specimen were obtained and compared with data for 25-mm- and 12.5-mm-thick specimens of similar geometries. The large cryogenic hydraulic tensile machine, a ten-metric-ton cryogenic multispecimen tensile machine, and a ten-metric-ton cryogenic hydraulic machine are described.

800,987
PB89-123319 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Size, Side-Grooving, and Fatigue Precracking Effects on J-Integral Test Results for SUS 304 Stainless Steel at 4 K.

Final rept.,
M. Shimada, R. L. Tobler, T. Shoji, and H. Takahashi. 1988, 8p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in *Advances in Cryogenic Engineering*, v34 p251-258 1988.

Keywords: *Fracture tests, *Cryogenics, *Austenitic stainless steels, Samples, Thickness, Grooving, Static loads, Cracking(Fracturing), Fatigue(Materials), Experimental design, Reprints.

Tests were conducted to investigate specimen preparation effects on the J-integral fracture-test procedure at 4 K. Proportional compact specimens of a fully plastic steel were tested using the compliance technique. The J sub Ic measurements were not affected by side grooving, but decreased slightly as specimen thickness increased from 12.5 to 25.4 mm. The resistance curve slope decreased significantly with both thickness and side grooving. Fatigue precracking and sustained loading effects are discussed.

800,988

PB89-123335 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Cleavage-Like Fracture Along Slip Planes in Fe-18Cr-3Ni-13Mn-0.37N Austenitic Stainless Steel at Liquid Helium Temperature.

Final rept.,
R. L. Tobler, and D. A. Meyn. 1988, 6p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in *Metallurgical Transactions A* 19A, p1626-1631 Jun 88.

Keywords: *Brittle fracturing, *Cryogenics, *Austenitic stainless steels, Fatigue(Materials), Nitrogen, Yield strength, Loads(Forces), Face centered cubic lattices, X ray diffraction, Cleavage, Sliding, Reprints.

Contrary to usual expectations, some nitrogen-alloyed austenitic stainless steels exhibit brittle fracture at temperatures approaching absolute zero despite their face-centered-cubic crystal structure. Plane strain fracture toughness and fractographic data are presented for an Fe-18Cr-3Ni-13Mn-0.37N steel tested at a liquid helium temperature (4 K). Low toughness (K sub Ic = 71 MPa.m sup 1/2) and linear-elastic loading behavior was observed in 25-mm-thick compact specimens at this temperature, in association with a high tensile yield strength and a brittle failure mode consisting of transgranular facets. The transgranular facets produced in a coarse-grained sample of this steel at 4 K were identified by Laue x-ray diffraction and slip line trace analysis as having formed on {111} austenite planes, which implies that slip-plane decohesion may be the brittle failure micromechanism.

800,989

PB89-124010 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Pulsed Laser/Electromagnetic Acoustic Transducer Approach to Ultrasonic Sensor Needs for Steel Processing.

Final rept.,
G. A. Aiers, and H. N. G. Wadley. 1987, 12p
Pub. in *Review of Progress in Quantitative Nondestructive Evaluation*, v6A p627-638 1987.

Keywords: *Steels, *Ultrasonic tests, *Porosity, Sound transducers, Lasers, Electromagnetic wave transmission, Samarium, Cobalt, Magnetic alloys, High temperature tests, Reprints.

A lightweight, easily scanned EMAT receiver probe has been constructed out of heat resistant materials and samarium cobalt permanent magnets to withstand intermittent use at high temperatures. It has been optimized for use with a pulsed laser ultrasonic source. The sensor was able to detect 1 MHz ultrasonic pulses generated by a focused 175 millijoule laser pulse with a signal-to-noise ratio of 40:1 (32 dB) on a mild steel block with a surface temperature of 810 deg C. The sensor shows promise for the noncontact detection and characterization of gross internal porosity in hot steel bodies.

800,990

PB89-126759 Not available NTIS

National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Strength, Fatigue, and Toughness Properties of an Fe-18Cr-16Ni-6Mn-2Mo Fully Austenitic SMA (Shielded-Metal-Arc) Weld at 4 K.

Final rept.,
R. L. Tobler, R. E. Trevisan, T. A. Siewert, H. I. McHenry, and P. T. Purtscher. 1988, 8p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in *Advances in Cryogenic Engineering*, v34 p351-358 1988.

Keywords: *Austenitic stainless steels, *Cryogenics, *Shielded metal arc welding, *Low temperature tests, Ductility, Fracture strength, Microstructure, Crack propagation, Weldments, Iron alloys, Chromium alloys, Nickel alloys, Manganese alloys, Molybdenum alloys, Reprints.

A fully austenitic stainless steel butt weld was produced by shielded-metal-arc (SMA) welding using a new filler composition: Fe-18Cr-16Ni-6Mn-2Mo. The weld, 25-mm thick, contained no microfissures. Strength, fatigue crack growth rate, and fracture toughness properties at 4 K are reported. The weld fracture toughness falls 20% below typical values for wrought and annealed austenitic stainless steel base metals of equivalent strength but is high compared to conventional type 308L and 316L SMA welds. The intermediate toughness is explained by microstructural differences.

800,991

PB89-126767 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Effects of Specimen Size, Side-Grooving, and Precracking Temperature on J-Integral Test Results for AISI 316LN at 4 K.

Final rept.,
T. Ogata, K. Ishikawa, T. Yuri, R. L. Tobler, P. T. Purtscher, R. P. Reed, T. Shoji, K. Nakano, and H. Takahashi. 1988, 8p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in *Advances in Cryogenic Engineering*, v34 p259-266 1988.

Keywords: *Austenitic stainless steels, *Fracture strength, *Cryogenics, *Sampling, Toughness, Low temperature tests, Loads(Forces), Crack propagation, Reprints, 316LN alloy, J-integral test.

The effects of specimen size, side grooves, and fatigue precracking temperature on J-integral fracture toughness test results were investigated to support the development of a standard 4 K test procedure. The test material was an AISI 316LN alloy. The tests used compact specimens and a computer-controlled unloading compliance technique. Fatigue precracking at various temperatures (293, 77, or 4 K) had no apparent effect on fracture toughness measurements at 4 K. For plain specimens, the fracture toughness decreased with increasing specimen thickness in the range 25 to 38 mm. The toughness also decreased with application of side grooves.

800,992

PB89-126775 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Round Robin Tensile and Fracture Test Results for an Fe-22Mn-13Cr-5Ni Austenitic Stainless Steel at 4 K.

Final rept.,
H. Nakajima, K. Yoshida, S. Shimamoto, R. L. Tobler, P. T. Purtscher, and R. P. Reed. 1988, 9p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in *Advances in Cryogenic Engineering*, v34 p241-249 1988.

Keywords: *Austenitic stainless steels, *Fracture strength, *Low temperature tests, *Standards, *Precision, Cryogenics, International relations, Cooperation, Tensile strength, Iron alloys, Manganese alloys, Chromium alloys, Nickel alloys, Reprints, Round robin tests.

Round robin tests are a part of the U.S.-Japan cooperative program to develop standard tensile and fracture test procedures for austenitic stainless steels at 4 K. The first round of tests for an Fe-22Mn-13Cr-5Ni steel are described in the paper. The interlaboratory scatter in 4 K measurements is reported and relevant aspects of test procedure are discussed.

800,993

PB89-126791 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Inclusions and Fracture Toughness in Stainless Steel Welds at 4 K.

Final rept.,
C. N. McCowan, and T. A. Siewert. 1988, 8p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in *Advances in Cryogenic Engineering*, v34 p335-342 1988.

Keywords: *Stainless steels, *Cryogenics, *Weld defects, *Fracture strength, Weldments, Low temperature tests, Oxygen, Inclusions, Toughness, Reprints.

Eight stainless steel welds were studied to evaluate the effect of inclusion content on the fracture toughness at 4 K. The loss in toughness associated with the inclusion spacing was found to agree with the trend previously determined between inclusion spacing and toughness in stainless steel base materials. This finding indicates that the smaller inclusion spacings observed in welds are the principal reason why welds have lower fracture toughness than base materials of similar compositions at 4 K and why some welds are tougher than others. Inclusion size distributions were found to be similar for the welds. The oxygen content of the welds is evaluated as an alternate means of representing the effect of inclusions on the weld toughness at 4 K.

800,994

PB89-126916 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Fracture and Deformation Div.

Acoustic Emission and Its Applications to Fracture Studies of Austenitic Stainless Steels at 4 K.

Final rept.,
H. Takahashi, T. Shoji, and R. L. Tobler. 1988, 9p
Sponsored by Department of Energy, Washington, DC. Office of Magnetic Fusion Energy.
Pub. in *Advances in Cryogenic Engineering*, v34 p387-395 1988.

Keywords: *Austenitic stainless steels, *Acoustic signals, *Cracking(Fracturing), *Cryogenics, Low temperature tests, Sound transmission, Emission, Ductility, Monitors, Metal alloys, Reprints.

In contrast to their silent cracking behavior at room temperature, the austenitic stainless steels are highly active acoustically during deformation and fracture at 4 K. Acoustic emission is promoted by low temperature strengthening and by discontinuous plastic flow in ductile alloys near absolute zero. Consequently, the prospects are quite good for acoustic emission monitoring as a tool for the study of austenitic steels at 4 K. The paper illustrates some potential applications.

Lubricants & Hydraulic Fluids

800,995

PB89-148985 PC A08/MF A01
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Chemical Performance and Standards Group.

Vapor Phase Deposition Studies of Phosphate Esters on Metal and Ceramic Surfaces.

Special pub. (Final),
D. E. Deckman, S. M. Hsu, and E. E. Klaus. Sep 88, 37p NIST/SP-754
Also available from Supt. of Docs. as SN003-003-02912-2. Library of Congress catalog card no. 88-600578. Prepared in cooperation with Pennsylvania State Univ., University Park. Dept. of Chemical Engineering.

Keywords: *Ceramics, *Metals, *High temperature lubricants, *Lubricants, *Vapor deposition, Coatings, Stainless steels, Copper, Nickel, Platinum, Thin films, *Vapor phase lubrication, *Phosphate esters.

The study focuses on a novel means of lubrication for ceramics and metals at high temperatures; called vapor phase lubrication. The deposition rate and mechanisms of tributyl phosphate ester and tricresyl phosphate ester have been explored. A Thermalgravimetric Analyzer (TGA) was modified to measure the

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Lubricants & Hydraulic Fluids

rate of surface film formation of vapor phase deposition of lubricants on metal surfaces at elevated temperatures. Results from TGA studies showed that the vapor deposition process was a complex function of substrate, time, and temperature. Tricresyl phosphate ester (TCP) and tributyl ester (TBP) were observed to produce similar amounts of film on stainless steel substrates. The observed order of metal activity was copper > stainless steel > nickel > platinum. Film formation on nickel was found to be much more rapid at 600 C than 700 C. Also, the concentration of oxygen present during deposition strongly influenced the amount of film formed. Scanning electron microscopy was conducted on TBP films formed on Si₃N₄, Al₂O₃, and alpha-SiC. The films produced contained globule and filamentous structures. The films on each ceramic were unique, demonstrating that vapor deposition is surface sensitive on ceramic substrates. High temperature friction testing was conducted on a TCP coated Al₂O₃ substrate. The coating reduced the friction level for alumina, thus demonstrating the potential of vapor lubrication for high temperature lubrication of ceramics.

Pub. in International Jnl. of Fatigue 10, n2 p101-108 1988.

Keywords: *Fatigue(Materials), *Cracking(Fracturing), Ocean waves, Structural steels, Crack propagation, Reprints, Fracture mechanics.

The paper describes procedures for predicting the growth rate of fatigue cracks under sea-wave loading. The procedures start with an anticipated (or assumed) stress spectrum acting on a component of interest. Fatigue crack growth rates (FCGRs) are calculated using the fracture mechanics approach and an equivalent-stress-range concept. Experimental results have shown that use of the calculated equivalent-stress range, $h(eq)$ of the anticipated (or assumed) stress spectrum, coupled with constant-load-amplitude FCGR results, is adequate for predicting FCGRs under sea-wave loading. Results of assuming a fatigue exponent equal to 2 (root-mean square) or 3 (root-mean cube) are presented. The conservatism of approximating $h(eq)$ of wide-band random loading with the closed-form narrow-band solution is also discussed.

800,999

PB89-126882

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Automated Production Technology Div.

Monitoring of Wear of High-Speed Steel End Mills: Some Practical Considerations.

Final rept.,

L. Evans, 1987, 5p

Pub. in Carbide and Tool Jnl. 19, n1 p19-23 Jan/Feb 87.

Keywords: *Machine tools, *Wear, *Steel plants, Tool life, Tool steels, Measuring instruments, Reprints, *Tool wear.

A tool-wear monitoring instrument must meet certain conditions; it must be universal, robust, inexpensive, usable on-line, adaptable, reliable, and not interfere with fixturing. Four methods (spindle power consumption, feed force change, time-domain analysis of vibration, and change in resultant force (the magnitude of the resultant of the forces in the plane of the machine tool bed)) are compared according to the criteria. The paper discusses some practical considerations in implementing a tool wear monitor, and focuses on the use of the four methods to detect wear of high-speed steel end mills during peripheral and slot milling of two types of steel.

801,000

PB89-132971

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Metallurgy Div.

Applications of Microindentation Methods in Tribology Research.

Final rept.,

P. J. Blau, 1985, 18p

Pub. in Microindentation Techniques in Materials Science and Engineering, ASTM STP 889, p209-226 1986.

Keywords: *Friction factor, *Indentation hardness tests, *Wear, *Alloys, Microscopy, Microstructure, Abrasion, Reviews, Surface roughness, Erosion, Reprints, *Tribology.

Microindentation techniques and tribology research have traditionally been closely linked. Three aspects of their historical relationship are discussed: (1) the use of microindentations and scratches as indicators of small amounts of wear, (2) the characterization of candidate metal and alloy microstructures for wear applications, and (3) studies of microstructures that have been altered by various wear processes. Proper application of microindentation techniques can provide information beyond simply obtaining microindentation hardness numbers. For example, one can estimate mild wear losses, crystallographic texturing due to sliding, work hardening, and fine structure sizes below eroded surfaces, strength of transfer patches on severely worn surfaces, and the variation in contact conditions across a single wear scar. Many of these areas need to be explored in more extensive quantitative ways before the full power of microindentation methods in tribology can be utilized effectively. The author reviews several published studies as well as his recent work to illustrate future research opportunities.

801,001

PB89-141105

PC A03/MF A01
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Chemical Performance and Standards Group.

Accumulation and Fate of Tributyltin Species in Microbial Biofilms.

W. R. Blair, G. J. Olson, T. K. Trout, K. L. Jewett, and F. E. Brinckman. Sep 88, 24p NISTIR-88/3852
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Antifouling coatings, Tin organic compounds, Accumulation, Biodegradation, Aquatic microbiology, Concentration(Composition), *Biofilms, *Tributyltin, Bioconcentration.

Microbial biofilms, composed of microorganisms originally obtained from harbor-exposed organotin-painted panels, accumulated tributyltin (TBT) spiked into estuarine water. Algal and bacterial-dominated biofilms were grown by varying nutrient conditions. Both types of microbial communities accumulated TBT in excess of 300 ng/mg biomass (dry weight) from solutions containing 50 micrograms/L TBT, corresponding to bioconcentration factors of over 7000. No degradation of TBT to dibutyltin (DBT) species, either in the biofilm material or in the surrounding solution was detected in any of the experiments. Thus, the microbial biofilms concentrated but did not degrade TBT, suggesting that microbial films on TBT-painted structures in marine environments may act to concentrate TBT at materials surfaces, thereby acting as capacitors delivering extended antifouling service.

Materials Degradation & Fouling

800,996

PB88-175427

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD.

Role of Surface Stress in Fracture.

Final rept.,

R. Thomson, T. J. Chuang, and I. H. Lin. 1986, 11p

See also PB88-141098.

Pub. in Acta Metallurgica 34, n6 p1133-1143 Jun 86.

Keywords: *Fractures(Materials), *Surfaces, *Stresses, Cracks, Reprints.

Because of surface atomic structure changes relative to the bulk, intrinsic mechanical stresses are found in a general free surface, including surfaces of internal cracks. The paper presents a theoretical study of the elastic fracture behavior under the influence of these stresses. The interrelationships between surface stress, free energy and substrate volume stress are derived from the principles of thermodynamics and mechanics. Because of the lack of data on surface stress parameters, no quantitative predictions are possible for specific materials.

800,997

PB88-193768

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Metallurgy Div.

Galling Wear of Metals.

Final rept.,

M. B. Peterson, K. J. Bhansali, E. P. Whitenton, and L. K. Ives, 1985, 9p

Pub. in Proceedings of International Conference on Wear of Materials, Vancouver, British Columbia, Canada, April 14-18, 1985, p293-301.

Keywords: *Galling, *Wear, Metals, Surfaces, Friction, Steel 316.

Although galling wear is a well recognized wear process it has received little attention from tribology researchers. Very little is known as to what effects materials, design, and operational variables have on the galling process. The present work was initiated to answer these questions and to thus better understand the mechanism of galling. In the investigation it was found that the severity of galling was different for different materials and conditions. Thus it was necessary to determine a method of measuring this change. A variety of techniques were investigated; it was found that changes in galling surface damage could be measured by changes in surface topography. The best measure was maximum peak to valley roughness.

800,998

PB88-238647

Not available NTIS
National Bureau of Standards (NIST), Boulder, CO. Fracture and Deformation Div.

Fatigue Crack Growth Analysis Under Sea-Wave Loading.

Final rept.,

Y. W. Chen. 1988, 8p

Sponsored by Minerals Management Service, Reston, VA.

Miscellaneous Materials

801,002

PB88-230487

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Building Equipment Div.

Thermodynamic Evaluation of Refrigerants in the Vapour Compression Cycle Using Reduced Properties.

Final rept.,

M. O. McLinden. 1988, 10p

Pub. in International Jnl. of Refrigeration 11, p134-143 May 88.

Keywords: *Refrigerants, *Thermodynamic properties, *Heat pumps, Heating equipment, Reprints.

The effects of fluid thermodynamic properties on the performance of the theoretical vapor compression cycle are analyzed. By investigating in reduced co-ordinates a characteristic refrigerant and deviations from it, virtually all possible fluids are considered. The most important factor in determining performance is critical temperature. Most properties involve a trade-off between high COP and high heating or cooling capacity, however there is an optimum heat capacity and a high critical pressure increases system capacity with no penalty on COP. The analysis would be useful in finding new fluids for high temperature applications, but reveals that fluids superior to present refrigerants are not likely for lower temperatures.

801,003

PB88-243373

PC A05/MF A01
National Bureau of Standards, Gaithersburg, MD.

Working Fluid Selection for Space-Based Two-Phase Heat Transport Systems.

M. O. McLinden. Aug 88, 76p NBSIR-88/3812

Sponsored by National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.

Keywords: *Heat transfer, *Thermal conductivity, Refrigerants, Temperature measurement, Freezing, Critical point, Heat of vaporization, Factor analysis, *Working fluids, *Spacecraft equipment, Cold plates.

The working fluid for externally-mounted, space-based two-phase heat transport systems is considered. A sequence of screening criteria involving freezing and critical point temperatures and latent heat of vaporization and vapor density are applied to a data base of 860 fluids. The thermal performance of the 52 fluids which pass this preliminary screening are then ranked according to their impact on the weight of a reference system. Upon considering other non-thermal criteria (flammability, toxicity and chemical stability) a final set of 10 preferred fluids is obtained. The effects of variations in system parameters is investigated for these 10 fluids by means of a factorial design.

Nonferrous Metals & Alloys

801,004
PB88-174156 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg,
 MD. Metallurgy Div.
Metallography of Quasicrystals.
 Final rept.,
 R. J. Schaefer. 1986, 6p
 Pub. in Scripta Metallurgica 20, n9 p1187-1192 Sep
 86.

Keywords: *Crystal structure, Aluminum alloys, Man-
 ganese containing alloys, Solidification, Crystal
 growth, Reprints, *Quasicrystals, Icosahedral phase,
 Rapid quenching (Metallurgy).

Numerous workers have now produced icosahedral
 quasicrystals by rapid solidification as described by
 Shechtman et al., and many of them have used the
 originally reported composition of approximately 14
 at% Mn, corresponding to the formula Al_6Mn . In addi-
 tion, there is now a rapidly expanding list of reports of
 quasicrystalline phases in different alloy systems or
 produced by different processing methods. Only in Al-
 Mn and closely related systems, however, has enough
 work been done to form a reasonably detailed under-
 standing of the physical metallurgy of the quasicrystal-
 line phases. The paper reviews the conditions under
 which quasicrystals form in Al-based systems and
 points out some of the implications of quasicrystal for-
 mation in other systems.

801,005
PB88-175419 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg,
 MD.
**High Resolution Electron Microscopy of the Icosa-
 hedral Quasiperiodic Structure in Al-Mn System.**
 Final rept.,
 R. Portier, D. Shechtman, D. Gratias, and J. W.
 Cahn. 1985, 10p
 Pub. in Jnl. of Microscopy and Spectroscopy Electron
 10, n2 p107-116 May 85.

Keywords: *Crystal structure, Aluminum alloys, Man-
 ganese containing alloys, Reprints, *Quasicrystals,
 Icosahedral phase, High resolution, Transmission
 electron spectroscopy, Shechtmanite.

The high resolution study in France of the icosahedral
 phase discovered at NBS examines the structure
 along all of the symmetry axes as well as along some
 others that are perpendicular to symmetry axes. All as-
 pects are consistent with a quasiperiodic structure on
 a lattice that results from a cut and projection of a six-
 dimensional primitive cubic lattice. The unit length
 along the rhombohedra in three dimensions is 0.46
 nm.

801,006
PB88-177324 Not available NTIS
 National Bureau of Standards (IMSE), Boulder, CO.
 Fracture and Deformation Div.
**Notch Tensile Measurements and Fracture Tough-
 ness Correlations for Austenitic Stainless Steels.**
 Final rept.,
 R. P. Reed, D. T. Read, and R. L. Tobler. 1986, 8p
 Sponsored by Department of Energy, Washington, DC.
 Pub. in Advances in Cryogenic Engineering Materials,
 v32 p361-368 1986.

Keywords: Materials, Reprints, *Stainless steels, Cryo-
 genic properties, *Fracture toughness, *Notch tensile
 tests.

Thirty-two alloys were included in a study of notch ten-
 sile testing as a method of fracture toughness charac-
 terization for austenitic stainless steels at 4 K. For the
 same austenitic stainless steels, tensile and J-integral
 fracture toughness ($K_{Ic}(J)$) measurements have
 been conducted. The notch tensile strength (σ_{NTS})
 generally increases with yield strength (σ_y), and the
 sigma NTS/sigma y ratios are typically much greater
 than 1.0. Correlations between sigma NTS, $K_{Ic}(J)$, and
 sigma y were assessed. The best data fit was found be-
 tween the ratio sigma NTS/ $K_{Ic}(J)$ and the toughness,
 $K_{Ic}(J)$. Unfortunately, from this relation there is not
 uniqueness of $K_{Ic}(J)$ from sigma NTS. There are three
 regions in plots of J-integral fracture toughness vs.
 cylindrical bar notch-tensile measurements: (1) linear
 elastic (sigma NTS increases as $K_{Ic}(J)$ increases); (2)
 elastic-plastic (sigma NTS is essentially independent of
 $K_{Ic}(J)$); (3) plastic (sigma NTS decreases as
 $K_{Ic}(J)$ increases). The elastic-

plastic region is associated with a plastic zone that ex-
 tends completely through the notched cross-sectional
 area.

801,007
PB88-189162 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg,
 MD. Surface Science Div.
**Nucleation and Epitaxial Growth of Cr Crystals on
 Stepped W Surfaces with Low-Index Facets.**
 Final rept.,
 A. J. Melmed, and N. D. Shinn. 1988, 11p
 Sponsored by Department of Energy, Washington, DC.
 Pub. in Surface Science 193, p475-485 1988.

Keywords: *Chromium, *Crystal growth, Vapor plating,
 Tungsten, Substrates, Oxygen, Nucleation, Metal
 films, Thin films, Reprints, *Epitaxial growth.

The nucleation and epitaxial growth of Cr overlayers
 and crystals have been studied by vapor depositing
 chromium onto thermally annealed W field electron
 emitters, which provide highly stepped substrates with
 low-index facets of various atomic configurations. Tem-
 perature and substrate morphology effects were iden-
 tified and Cr/W epitaxial relationships were deter-
 mined. The influence of oxygen contamination is iden-
 tified, and comparisons to recent Cr/W(001) and Cr/
 W(110) work are made.

801,008
PB88-190178 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg,
 MD. Metallurgy Div.
Alpha Manganese and the Frank Kasper Phases.
 Final rept.,
 R. E. Watson, and L. H. Bennett. 1985, 4p
 Pub. in Scripta Metallurgica 19, n4 p535-538 1985.

Keywords: *Manganese, Antiferromagnetism, Re-
 prints, Frank-Kasper phases.

Using the radical Wigner-Seitz cell construction, it is
 shown that alpha manganese is not a topologically
 closed packed phase, as defined by Frank and
 Kasper. The Mn III site, although 14-fold, is not (0, 0,
 12, 2) but is (0, 1, 10, 3). The disclination lines for
 alpha Mn have been defined for the first time, and re-
 lated to its antiferromagnetism.

801,009
PB88-192158 Not available NTIS
 National Bureau of Standards (IMSE), Boulder, CO.
 Fracture and Deformation Div.
**Use of Ultrasonics for Texture Monitoring in Alumi-
 num Alloys.**
 Final rept.,
 A. V. Clark, A. Govada, R. B. Thompson, J. F. Smith,
 G. V. Blessing, P. P. Del Santo, and R. B. Mignogna.
 1987, 10p
 Pub. in Review of Progress in Quantitative Nonde-
 structive Evaluation, Chapter 6B, v2 p1515-1524 1987.

Keywords: *Aluminum alloys, Nondestructive tests, Ul-
 trasonics, Acoustics, Texture, Reprints, Ultrasonic flaw
 detection.

In the manufacture of aluminum products such as
 rolled plate, it is desirable to monitor the preferred or-
 ientation (texture) of the material. Recent theoretical
 advances have shown how the phase velocity of
 sound waves can be related to the texture in polycrys-
 talline aggregates. Measurements of phase velocity can
 be used to obtain three orientation distribution co-
 efficients (ODC), denoted as omega(sub 420). (These
 ODC characterize the texture in an aggregate of cubic
 crystallites which displays orthotropic symmetry.) Ul-
 trasonic measurements of omega(sub 420) and
 omega(sub 440) were made in plates of two aluminum
 alloys. Measurements of acoustic birefringence were
 made using both EMATs and conventional piezoelec-
 tric transducers with dry couplant. Measurements of
 the lowest-order Lamb and SH-wave modes were
 made with EMATs. Measurements of the Rayleigh
 wave velocity were made with two different devices,
 both using piezoelectric transducers. For the authors
 particular application, texture monitoring for can manu-
 facturing, measurement of omega(sub 440) with either
 the lowest order Lamb-wave or SH-wave mode ap-
 pears most promising.

801,010
PB88-192190 Not available NTIS
 National Bureau of Standards (IMSE), Boulder, CO.
 Fracture and Deformation Div.

Deformed-Polycrystalline-Copper Elastic Con-
 stants.

Final rept.,
 H. M. Ledbetter, and M. W. Austin. 1987, 10p
 Sponsored by Department of Energy, Washington, DC.
 Office of Fusion Energy.
 Pub. in Phys. Stat. Sol. (a) 104, p203-212 1987.

Keywords: *Copper, Elastic properties, Plastic defor-
 mation, Ultrasonic radiation, Texture, Reprints, Dislo-
 cations.

By ultrasonic methods, the principal macroscopic-orth-
 otropic-symmetry elastic constants are studied of plas-
 tically deformed copper plate. By X-ray diffraction, a
 strong plate texture is verified, which is identified as
 (110) (in brackets: 1 -1 2, 1 -1 -1). From the monocrys-
 tall elastic constants, the macroscopic elastic con-
 stants expected for ideal textures are calculated. Pre-
 diction fails to fit observation; mostly, the predicted
 elastic stiffness is too high. This disagreement is as-
 cribed to a high density of deformation-induced dislo-
 cations. To the elastic-constant measurements, these
 dislocations contribute a reversible plastic strain. For
 the elastic shear stiffnesses the usual $C_{ijkl} = C_{jikl}$ macro-
 scopic symmetry failed. This breakdown is as-
 cribed to dislocation-array anisotropy. For the elastic
 constants, the dislocation contribution overwhelms the
 texture contribution. After plastic deformation, the
 elastic constants show an ambient-temperature time
 dependence.

801,011
PB88-193776 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg,
 MD. Metallurgy Div.
**Formation of Quasicrystals in Rapidly Solidified Al
 Alloys.**
 Final rept.,
 R. J. Schaefer, and L. A. Bendersky. 1986, 12p
 Pub. in Rapidly Solidified Alloys and Their Mechanical
 and Magnetic Properties, p217-228 1986.

Keywords: *Aluminum manganese alloys, Aluminum
 silicon alloys, Solidification, Electron beams, *Quasi-
 crystals, Icosahedral phase, Rapid quenching (Metal-
 lurgy).

Electron beam surface melting has been used to study
 Al-Mn and Al-Mn-Si alloys subjected to a wide range of
 solidification conditions. Several of the reported equi-
 librium intermetallic phases are not found even at moderate
 growth rates. Beyond a composition-dependent critical
 velocity, the equilibrium phases are all replaced by the
 quasicrystalline icosahedral and decagonal (T) phases.
 The icosahedral phase is favored over the T phase by
 higher solidification velocities. The addition of Si to
 Al-Mn alloys eliminates the T phase, but does not
 significantly facilitate the formation of the icosahedral
 phase by electron beam melting because the ternary
 alpha and beta phases of Al-Mn-Si are able to grow
 rapidly into the electron beam melt scans.

801,012
PB88-193784 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg,
 MD. Metallurgy Div.
**Thermodynamic Assessment of the Iron Noble-
 Metal Equilibrium Diagrams.**
 Final rept.,
 L. J. Swartzendruber. 1986, 9p
 Pub. in Proceedings of Conference on Noble Metal
 Alloys: Phase Diagrams, Alloy Phase Stability, Ther-
 modynamic Aspects, Properties and Special Features,
 New York, NY., February 24-28, 1985, p305-313 1986.

Keywords: *Iron alloys, *Gold alloys, *Copper alloys,
 *Silver alloys, *Phase diagrams, *Thermodynamics.

The three iron noble-metal alloy systems Fe-Au, Fe-
 Cu, and Fe-Ag are similar in that they all have a misci-
 bility gap in the solid state. In Fe-Ag, mutual solubilities
 are very low and the miscibility gap extends to a very
 high temperature in the liquid state. Thermodynamic
 models are presented which successfully represent the
 available experimental phase boundaries and ther-
 modynamic information and which can be used to esti-
 mate the metastable extension of the phase bound-
 aries, the spinodals, and the T₀ (equal G) curves.

801,013
PB88-193842 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg,
 MD. Gas and Particulate Science Div.

MATERIALS SCIENCES

Nonferrous Metals & Alloys

Application of Digital SIMS (Secondary Ion Mass Spectrometry) Imaging to Light Element and Trace Element Mapping.

Final rept.,
D. Newbury, D. Bright, D. Williams, C. Sung, T. Page, and J. Nessim. 1986, 3p
Pub. in Springer Ser. Chem. Phys. 44, p261-263 1986.

Keywords: Lithium alloys, Aluminum alloys, Microstructure, Crystals, Mapping, Trace elements, Lithium, Distribution, Ion spectroscopy, Mass spectroscopy, Chemical analysis, Reprints, *Aluminum lithium alloys, Imaging techniques.

The determination of the relationship of compositional microstructure to morphological microstructure is often critical for elucidating structure-property relationships in materials. Imaging by secondary ion mass spectrometry (SIMS) offers two special capabilities which extend substantially beyond the limitations of electron probe microanalysis. These capabilities, light element and trace element imaging, have been employed in the work in two materials science problems: (1) the distribution of lithium in Al-Li alloys; and, (2) the origin of differences in the secondary electron coefficient observed in crystals in reaction-bonded SiC.

801,014

PB88-217815 Not available NTIS
National Bureau of Standards (NBS), Gaithersburg, MD. Radiation Physics Div.

Al L_{2,3} and Mg Double-Ionization Emission Spectra of Dilute Al in Mg Alloys.

Final rept.,
C. H. Zhang, K. L. Tsang, T. A. Callcott, D. L. Ederer, and E. T. Arakawa. 1988, 7p
Grant NSF-DMR85-03541

Sponsored by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC. Pub. in Physical Review B 37, n5 p2401-2407, 15 Feb 88.

Keywords: Aluminum, Reprints, *Magnesium alloys, *Emission spectra.

The Al L(sub 2,3) spectrum for dilute alloys of Al in Mg, and the Mg L satellite spectrum produced by transitions in atoms with doubly ionized 2p core levels have been measured. The two spectra contain similar features associated with screening of the extra core hole, but are otherwise dissimilar, which suggests that the equivalent-core approximation is not valid. The threshold peak is broadened in both spectra. The Al-impurity spectrum is found to be about 1 eV wider than that of the Mg host. The L(sub 3) - L(sub 1) intercore transition in doubly ionized Mg is observed. Finally, a second, weak, high-energy satellite of Mg is observed that may be produced by transitions from the singlet S(sub 0) state of the doubly ionized core levels. These results provide important new data for comparison with theories of the electronic states of impurity atoms in metals.

801,015

PB88-217948 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Corrosion Behavior of Electrodeposited Aluminum-Manganese Alloys.

Final rept.,
D. E. Hall, and G. R. Stafford. 1988, 1p
Sponsored by Electrochemical Society, Inc., Pennington, NJ.
Pub. in Electrochemical Society Extended Abstracts, v88-1 1p May 88.

Keywords: *Corrosion, Electrodeposition, Reprints, *Aluminum manganese alloys.

Al-Mn alloy coatings up to 35 percent Mn were electrodeposited from molten salt baths. The corrosion behavior of these alloys and pure aluminum was studied in aqueous 0.1M NaCl electrolyte. Alloys containing more than 13 percent Mn had breakdown potentials more than 0.4V positive of the breakdown potential for pure aluminum. The pits formed in these alloys were shallower and broader than those in aluminum. These and other results are discussed.

801,016

PB88-217963 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Study of the Coarsening of Liquid-Solid Mixtures Using Synchrotron Radiation Microradiography.

Final rept.,
W. J. Boettinger, P. W. Voorhees, R. C. Dobbryn, and H. E. Burdette. 1987, 4p
Pub. in Metallurgical Transactions A 18A, p487-490 Mar 87.

Keywords: *Microradiography, *Alloys, Synchrotron radiation, Metallography, Reprints, *Liquid solid mixtures, *Coarsening, Ostwald ripening.

The coarsening of liquid-solid mixtures with high volume fraction solid is an important process in metallurgy. The development of secondary arm spacings in castings and the sintering of powders using a liquid phase are but two examples. The theory of Ostwald ripening is widely used to model these processes, yet microstructural details important at high volume fraction solid are usually ignored. The authors report preliminary studies on the coarsening of a liquid-solid mixture observed at temperature by microradiography using synchrotron radiation.

801,017

PB89-101513 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Transverse Magnetoresistance of Oxygen-Free Copper.

Final rept.,
F. R. Fickett. 1988, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetism 24, n2 p1156-1158 Mar 88.

Keywords: *Copper, Oxygen, *Low temperature tests, *Magnetoresistivity, Radiation effects, Cold working, Extrapolation, Reprints, Kohler plot.

Recent studies on the magnetoresistance of copper with residual resistance ratios (RRR) in the range 100-1000, using cold work and irradiation as parameters modifying RRR, show a large spread on a Kohler plot. The spread is much larger than that found in the authors' earlier work on very pure copper in which they used temperature as the main variable. Results of 4 K magnetoresistance measurements on a large number of samples of copper from various sources and in various states of cold work, strain, and reanneal are reported. A new look is taken at the Kohler plot as a method for predicting magnetoresistive behavior.

801,018

PB89-101620 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Acoustic Emission Studies of Electron Beam Melting and Rapid Solidification.

Final rept.,
R. B. Clough, H. N. G. Wadley, and F. S. Biancianiello. 1984, 14p
Pub. in Proceedings of Conference on Nondestructive Evaluation: Application to Materials Processing, Philadelphia, PA., October 3-4, 1983, p27-40 1984.

Keywords: *Aluminum, *Solidification, Fractures(Materials), *Acoustic emissions, *Electron beam melting, *Rapid quenching (Metallurgy), *Aluminum alloy 4Cu.

Acoustic emission is a technique well suited for monitoring electron beam induced melting and rapid solidification, since it provides a real-time, volumetric survey of the process. Heat flow calculations are now available which can accurately predict the extent and rate of solidification. These include both one and two dimensional heat flow, moving and stationary sources, pure and alloy systems. The present study examines the origin of acoustic emission during melting and rapid solidification of aluminum and aluminum 4 percent Cu using heat flow-microstructure-acoustic emission correlations.

801,019

PB89-101679 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Low Temperature Elastic Constants of Deformed Polycrystalline Copper.

Final rept.,
H. M. Ledbetter, and S. A. Kim. 1988, 6p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Materials Science and Engineering A 101, p87-92 1988.

Keywords: *Ultrasonic tests, *Copper, Plastic deformation, Dislocations(Materials), *Elastic properties, Low temperature tests, Microstructure, Solid phases, *Polycrystalline, *Deformation, Reprints.

By ultrasonic methods, the authors studied copper's elastic constants between 295 and 4 K. The specimens consisted of polycrystals deformed by rolling. At ambient temperature, compared with annealed texture-free copper, the deformed specimens usually showed lower elastic stiffness: up to 11 percent in Young's modulus and 19 percent in shear modulus. The Poisson ratio increased up to 14 percent. These softening reflect three internal-structure changes: texture, non-pinned dislocation density and anisotropic dislocation array. Cooling to 4 K showed regular behavior, nearly the same as for annealed texture-free copper. After plastic deformation, at ambient temperatures, the elastic constants showed time-dependent recovery.

801,020

PB89-119101 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Microsegregation in Rapidly Solidified Ag-15 wt% Cu Alloys.

Final rept.,
W. J. Boettinger, L. A. Bendersky, S. R. Coriell, R. J. Schaefer, and F. S. Biancianiello. 1987, 9p
Pub. in Jnl. of Crystal Growth 80, n1 p17-25 Jan 87.

Keywords: *Silver containing alloys, *Copper alloys, *Solidification, *Crystallization, Quenching(Cooling), Cellular materials, Impurities, Inclusions, Reprints.

Spacings and composition profiles of cellular structures formed in Ag-15 wt% Cu alloys at growth rates between 0.1 and 18 cm/s are measured. At the highest rates the cell spacings exceed the characteristic diffusion length D/V (ratio of liquid diffusion coefficient to growth rate) by a factor of ten. The rate of increase of the average cell composition with growth velocity is larger than predicted by existing diffusion models of the cell tip. Increases in cell compositions beyond the Ag solidus retrograde are accounted for quantitatively by the use of non-equilibrium interface conditions (solute trapping).

801,021

PB89-123970 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Acoustic Emission Characterization of the Martensitic Phase Transformation in NiTi.

Final rept.,
M. Gvishi, M. Rosen, and H. N. G. Wadley. 1985, 9p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v4B, p651-659 1985.

Keywords: *Nickel alloys, *Titanium alloys, *Martensite, *Ultrasonic tests, Crystal structure, Acoustic measurement, Nondestructive tests, Cooling, Heating, Shape, Emission, Reprints.

Acoustic emission during cooling and heating of equiatomic NiTi crystals has been detected and utilized to characterize kinetic aspects of a martensitic transformation. The martensitic transformation on cooling starts at 0 deg C and is complete at -103 deg C. On heating, the reverse transformation to austenite begins at 85 deg C and is complete at 150 deg C. Models of the transformation indicate that laths of greater than 4000 cubic micrometers were the emission source.

801,022

PB89-124119 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.

Structural Determination of the Al-Mn Icosahedral Phase.

Final rept.,
J. W. Cahn, and D. Gratias. 1986, 10p
Pub. in Jnl. of Phys. Colloq. 47, nC-3 p415-424 Jul 86.

Keywords: *Metal alloys, *Crystal structure, *Mathematical models, Aluminum alloys, Manganese alloys, Crystal lattices, Neutron scattering, X-ray diffraction, Phase, Reprints, Mackay icosahedron.

The simplest model of a quasicrystal with basis was developed: identical motifs are placed on every point of a quasilattice obtained by the cut and project method. The model was compared with neutron diffraction intensities and published x-ray results. The

particular quasilattice and motif are closely tied to the emerging consensus that the structure is composed mainly of parallel 54 atom clusters (mackay icosahedra) linked along their 3-fold axes. In the model the scattering amplitude is factorable into a motif factor and a quasilattice. The quasilattice has its closest point-to-point separation along the 3-fold axis and a cut figure was developed which gives close to the highest possible density consistent with this separation. The motif scattering factor differs from x-rays and neutrons. The calculated scattering intensity of this structure is in qualitative agreement with both neutron and x-ray scattering experiments.

801,023

PB89-127005

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Role of Hydrogen in Corrosion Fatigue of High Purity Al-Zn-Mg Exposed to Water Vapor.

Final rept., R. E. Ricker, and D. J. Duquette. 1988, 9p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in Metallurgical Transactions A 19A, p1775-1783 Jul 88.

Keywords: *Hydrogen embrittlement, *Aluminum alloys, *Fatigue(Materials), Nitrogen, Humidity, Zinc alloys, Magnesium alloys, Diffusion coefficient, Air, Corrosion, Tests, Reprints.

Corrosion fatigue tests were performed on samples of a high purity Al-Zn-Mg alloy in humid nitrogen gas after pre-exposure to either vacuum or humid air. The results of these tests were compared to the results of fatigue tests performed in dry nitrogen, used as an inert reference environment, after the same pre-exposure treatments. The pre-exposure times were calculated by assuming that bulk diffusion of hydrogen was the rate limiting process in either hydrogen adsorption or desorption. Water vapor in the testing environment resulted in reduced fatigue lives; however, pre-exposure to humid air was just as detrimental as water vapor in the test environment. The pre-exposure embrittlement effect of humid air was found to be completely reversible when the samples were stored in a vacuum long enough to remove hydrogen, assuming a bulk diffusion coefficient of 1×10^{-13} m²/sec. These results confirm the hypothesis that the reduced fatigue lives of Al-Zn-Mg alloys in water vapor is due to hydrogen embrittlement.

801,024

PB89-133011

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Modelling of the Potential at the Tip of a Transgranular Stress-Corrosion Crack in the Alpha-Brass-Ammonia System.

Final rept., U. Bertocci, and E. N. Pugh. 1987, 12p
Pub. in Proceedings of Corrosion Chemistry within Pits, Cracks and Cracks Conference, Teddington, England, October 1-3, 1984, p187-198 1987.

Keywords: *Stress corrosion cracking, *Brasses, *Ammonia, *Mathematical models, *Crack propagation, Corrosion, Electrical potential, Transgranular corrosion, Ammonium hydroxide.

The electrical potential difference between metal and solution at the tip of a transgranular crack during stress-corrosion cracking of alpha-brass in aqueous ammonia has been calculated by modelling the current and potential distribution on the bare walls of a wedge-shaped crack. Periodic minima in potential are caused by the discontinuous nature of the crack advance. The range of likely values for the potential minimum are deduced. The results show that hydrogen discharge at the crack tip has very little chance of occurring. A qualitative description of the variations of the crack-tip potential between minima is also given.

Plastics

801,025

PB88-164058

PC A03/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

Initial Investigation of the Properties and Performance of Magnesium Oxychloride-Based Foam Thermal Insulation.

W. J. Rossiter, and P. W. Brown. Dec 87, 47p
NBSIR-87/3642
Sponsored by Department of Energy, Washington, DC.

Keywords: *Foam, Properties, Characteristics, Density, Insulation, Moisture content, Construction materials, *Magnesium oxychloride.

The study is an initial investigation of the properties and performance of magnesium oxychloride-based foam thermal insulation. Tests and observations were performed on samples prepared in the laboratory and also removed from one cavity of a wall of a wood-frame house. The tests to characterize the foam included measurements of density, moisture content, shrinkage, and thermal conductivity, and analysis using X-ray diffraction, scanning electron microscopy, and thermogravimetry techniques. It was found that the foam had a thermal conductivity comparable to that of other insulations used to retrofit walls of houses. Shrinkage could not be quantified, but was seen to be generally small. The moisture content of the foam removed from the house was about 2 percent. The results of the analytical measurements indicated that the laboratory-prepared samples and some of those removed from the house were not identical. It was suggested that further analysis be conducted to continue characterization of the foam.

801,026

PB88-175740

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Structure, Morphology, and Models of Polymer Ferroelectrics.

Final rept., G. T. Davis. 1987, 29p
Pub. in Applications of Ferroelectric Polymers, Chapter 4, p37-65 1987.

Keywords: *Ferroelectric materials, *Polymers, Piezoelectric transducers, Pyroelectricity, Polyvinylidene fluorides, Vinylidene fluoride polymers.

Piezoelectric and pyroelectric polymer transducers are usually made from thin polymer films subjected to the temporary application of high electric fields. This process, called poling, aligns molecular dipoles preferentially in the direction of the field which remain aligned after the field is removed. Compensating charges reside in electrodes deposited on the surfaces of the film. Subsequent changes in stress or strain of the polymer cause an imbalance of charge between the net dipole per unit volume and the compensating charges at the surface. This chapter outlines the structure and morphology of semicrystalline polymers in general and polyvinylidene fluoride and its copolymers in particular. Crystal structure, polymorphism, interconversion of phases, and the nature of the Curie transition in polymers is discussed. A comparison of piezoelectric and pyroelectric properties of inorganic and polymeric materials is presented. The chapter concludes with a summary of molecular models for piezoelectric and pyroelectric response from polymers.

801,027

PB88-181854

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Polymer Standards.

Final rept., L. E. Smith, and P. H. Verdier. 1988, 9p
Pub. in Encyclopedia of Polymer Science and Engineering, v12 p690-698 1988.

Keywords: *Polymers, *Standards, Reprints.

No abstract available.

801,028

PB88-188354

PC A03/MF A01

Johns Hopkins Univ., Baltimore, MD. Center for Materials Research.

Thermal and Material Transport and the Solubility of Oxygen and Other Gases in Oxidizing Polymers.

Final rept., J. H. Flynn, and D. M. Levin. Mar 87, 28p NBS/GCR-87/524
Grant NANB-4D0040
Sponsored by National Bureau of Standards, Gaithersburg, MD.

Keywords: *Polymeric films, *Thermal conductivity, Heat transmission, Transport properties, Solubility, Oxygen, Gases, Oxidizers, Thermal diffusion.

Part A of the report deals with thermal transport in polymer sheets and includes a description of the experimental procedure, data and results, and a summary of the significance of the results. Part B is concerned with material transport and the solubility of oxygen and other gases in oxidizing polymers. The introduction to this section contains a discussion and explanation of diffusion phenomena as it applies to polymeric systems. This is followed by a description of the experimental procedure and parameters. The data and experimental results are given along with a discussion of the significance of the results and some recommendations.

801,029

PB88-189246

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Defect Diffusion Models for Internal Friction Processes in Polyethylene.

Final rept., D. H. Reneker, and J. Mazur. 1985, 8p
Pub. in Jnl. of Phys. Colloq. 46, nC-10 p499-506 Dec 85.

Keywords: *Polyethylene, *Crystal defects, Dislocation(Materials), Reprints.

Defect loops that encircle one chain in a polyethylene crystal are described in terms that are used to describe dislocation loops in metals. In a polyethylene crystal the defect loop which requires the least energy for creation belongs to the relatively unknown class of defects called dispirations. Dispirations can be thought of as defects in the helical symmetry of the polyethylene molecule in the crystal. The processes by which the diffusion of dispiration loops can contribute to relaxation processes in polyethylene are described.

801,030

PB88-192422

PC A04/MF A01

National Bureau of Standards, Gaithersburg, MD.

Reference Standard Polyethylene Resins and Piping Materials. Final Report October 1, 1986-September 30, 1987.

J. M. Grissman, C. M. Guttman, J. R. Maurey, B. M. Fanconi, and D. L. VanderHart. Mar 88, 71p NBSIR-88/3705, GRI-87/0326

Contract GRI-5084-260-1013
Also available from Suprt. of Docs. See also report dated Mar 87, PB87-173035. Sponsored by Gas Research Inst., Chicago, IL.

Keywords: *Plastic pipes, *Gas pipes, Standards, Polymers, Tensile tests, *Polyethylene resins, *Reference materials.

Polyethylene piping is currently in widespread use in gas distribution in the United States, and represents approximately 80% of new installation. Research that is currently being performed on gas pipes often employs many different polyethylenes selected from the large number of polyethylenes available for this use. This variation in materials makes it difficult to compare results from different research laboratories. To avoid this difficulty, the Gas Research Institute and the National Bureau of Standards (NBS) have undertaken to provide a permanent store of one particular polyethylene resin as well as piping and fittings made from it which would provide a source of well characterized materials for research related to gas distribution systems. The report describes characterizations performed on the two types of T-joints and the starting resin from which they were manufactured. In preliminary work it was found that the melt flow rate of material taken from the two types of joints differed from that of the starting resin and differed from each other by as much as a factor of two.

801,031

PB88-195078

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Diffusion of Linear and Cyclic Polymers in Semi-Dilute Solutions of Linear Polymers Measured by Fluorescence Recovery After Photobleaching.

Final rept.,
I. S. Choi, E. S. Wu, F. W. Wang, G. B. McKenna, R. E. Lowrey, G. Hild, P. Lutz, and P. Rempp. 1985, 6p
Pub. in Proceedings of ACS (American Chemical Society) Division of Polymeric Materials Science and Engineering, Chicago, IL, September 1985, p330-335.

Keywords: *Polystyrene, *Polymers, Molecular weight, Diffusion, Solutions, Measurement, Linearity, Cyclization, Photobleaching.

Linear and cyclic polystyrene polymers of narrow molecular weight distribution have been labelled with nitrobenzoxadiazole (NBD). The diffusion of NBD-labelled cyclic polystyrene in dilute and semi-dilute linear polystyrene solutions has been measured by fluorescence recovery after photobleaching over a concentration range from 0.02 g/ml to 0.3 g/ml. No significant difference has been found between the diffusion of the cyclic polystyrene polymer and the diffusion of the linear polystyrene polymer when they have the same molecular weight.

801,032

PB88-195086 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Electron Energy Loss Spectroscopy: Application to Synthetic Organic Polymers.

Final rept.,
R. M. Briber, and F. Khoury. 1988, 16p
Pub. in Jnl. of Polymer Science, Part B: Polymer Physics 26, p621-636 1988.

Keywords: *Polymers, *Spectrum analysis, Electron microscopes, Electron spectroscopy, Atomic structure, Reprints, *Organic polymers.

Electron energy loss spectroscopy has been examined as a possible tool for measuring the atomic composition of polymers on a local scale in the transmission electron microscope. Thin films of nylon 6,6 and single crystal lamellae of poly(chlorotrifluoroethylene) were investigated as model systems. Spectra were obtained using a 100 kV electron beam. Results for nylon 6,6 gave fairly good quantitative agreement between the measured relative atomic contents of carbon, nitrogen, and oxygen (77, 9, and 14%, + or - 5%, respectively) and the calculated values (75, 12.5, and 12.5%, respectively). Spectra obtained for poly(chlorotrifluoroethylene) single crystals revealed significant mass loss of chlorine as a function of electron dose.

801,033

PB88-198049 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Novel Methods of Preparing Polymers for High Resolution Transmission Electron Microscopy.

Final rept.,
B. F. Howell, and D. H. Reneker. 1988, 6p
Pub. in Materials Research Society Symposia Proceedings 115, p155-160 1988.

Keywords: *Polymers, *Fibers, Molecular structure, Microstructure, Cross sections, *Electron microscopy.

Three methods for preparing polymer samples in which molecular scale features can be observed were described. Different polymers display characteristic images at this level of resolution. Very small fibers containing only a few tens of molecules in their cross-sections were observed.

801,034

PB88-198056 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Multiple Glass Transitions in Bimodal Polystyrene Mixtures.

Final rept.,
S. S. Chang. 1988, 3p
Pub. in Polymer Communications 29, p33-35 Feb 88.

Keywords: *Polystyrene, *Polymers, *Glass transition temperature, Compatibility, Reprints, Monomers, Oligomers.

Monomers and oligomers are in general compatible with their polymer above the melting point of the polymer. When crystallization can be avoided, this type of mixture should produce an amorphous compatible

blend with a single glass transition temperature. However, mixtures of bimodal molecular weight distribution of sufficiently high molecular weight differences may easily be thermally treated to show either a single glass transition temperature or multiply glass transition temperatures, as a consequence of non-uniform distribution of relaxation times, which may result from a separation into concentration or density domains.

801,035

PB89-101745 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

¹³C CP-MAS NMR Study of Irradiated Polyethylene.

Final rept.,
E. Perez, and D. L. VanderHart. 1988, 15p
Pub. in Jnl. of Polymer Science: Part B. Polymer Physics 26, p1979-1993 1988.

Keywords: *Nuclear magnetic resonance, Carbon 13, *Polyethylene, Molecular weight, Ionizing radiation, Irradiation, *Radiation effects, Reprints.

Solid-state ¹³C-NMR was used to analyze several polyethylene samples, irradiated at room temperature with gamma rays in vacuum or with electrons in air up to a maximum dose of 200 Mrad. The main observed events were the formation of methyl ends and interior double bonds (vinylenes), as well as the disappearance of the initial vinyl ends. No signals associated with 'H' or 'Y' crosslinks were found in any of the samples. The partitioning of methyl ends and interior vinylenes between the crystalline and noncrystalline regions was determined only for the irradiated ultrahigh-molecular-weight polyethylene (UHMWPE) samples. Although concentration of methyl ends in the crystalline regions was approximately half that in the noncrystalline regions, the vinylenes had very similar concentrations in the two phases. Although some evidence for both cis and trans vinylenes appears in the spectrum of the noncrystalline regions, only one configuration (trans) seems to exist in the crystalline regions. No appreciable effect on the partitioning was detected after annealing the electron-irradiated UHMWPE samples for 16 h at 130 deg C.

801,036

PB89-118871 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.

Halogenated Polymeric Humidity Sensors.

Final rept.,
P. H. Huang. 1988, 9p
Pub. in Sensors and Actuators 13, p329-337 1988.

Keywords: *Polymers, *Humidity control, *Detectors, Thermodynamics, Halocarbon resins, Electrical resistivity, High temperature tests, Enthalpy, Entropy, Thin films, Hygroscopicity, Reprints.

The limitations of known organic polymer humidity sensors in humidity-sensing applications may be overcome through the use of halogenated organic polymers having pendant groups of both a relatively strong acidic type and a relatively weak acidic type. The combined advantages of halogen in the polymer and the presence of two pendant functional groups provides for a longer sensor life and stability. Thin membrane films of hygroscopic, fluorinated organic polymer having pendant functional groups of sulfonic acid and of carboxylic acid have been investigated for their electrical and thermodynamic characteristics for humidity sensing at high levels of relative humidity and elevated temperatures. Based on the measured conductance data, values of differential thermodynamic functions of enthalpy and entropy are found to be significantly larger than those previously obtained for a sensor system at relative humidities and temperatures above 70 percent and 50 deg C respectively.

801,037

PB89-126742 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Relating Creep and Creep Rupture in PMMA (Polymethylmethacrylate) Using a Reduced Variable Approach.

Final rept.,
J. M. Crissman, and G. B. McKenna. 1987, 11p
Pub. in Jnl. of Polymer Science Part B-Polymer Physics 25, n8 p1667-1677 1987.

Keywords: *Polymethyl methacrylate, *Creep rupture strength, Stressing, Failure, Thermal measurements,

Erosion, Wear, Quench aging, Reprints, Reduced variables.

Creep and creep rupture behavior of PMMA at high stresses have been characterized and found to be related using a reduced variables approach. It is shown that when the creep compliances can be correlated by a superposition principle for which the vertical shift is the ratio of the applied stress to a reference stress and strain at failure is a constant, a commonly used failure criterion (that the product of the strain rate at failure and the time to failure is constant) becomes valid. The reduced variables approach is found to apply to two greatly different thermal histories. Consistent with the concept of physical aging, the response of the quenched sample is simply shifted along the log time axis to shorter times relative to the response of the aged sample.

801,038

PB89-127096 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Laser Ionization Mass Spectrometry of Chromatography Column Packing Material.

Final rept.,
R. A. Fletcher, and A. J. Fatiadi. 1986, 12p
Pub. in Jnl. of Trace Microprobe Tech. 4, n3 p215-226 1986.

Keywords: *Polymers, *Mass spectrometry, *Column packings, Beads, Pyridines, Vinyl resins, Hydrochloric acid, Washing, Lasers, Chromatography, Reprints.

Commercial poly(4-vinylpyridine) and hydrochloric acid treated poly(4-vinylpyridine) beads have been investigated by laser ionization mass spectrometry using a Laser Microprobe Mass Analyzer (LAMMA 500). Typical mass spectra of the treated and untreated poly(4-vinylpyridine) are presented showing that relevant fragmentation ion patterns that characterize the polymer. The mass spectra of the HCl treated polymer beads after repeated washing still contain an abundance of chloride ion and chloride complex ions. The chloride ion is no longer detected in the mass spectra after the HCl treated beads are washed in ammonium hydroxide followed by methanol and water washes. It is thought that the chloride is ionically bound to the pyridine moiety.

Refractory Metals & Alloys

801,039

PB89-118921 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Thermal Expansion of Niobium in the Range 1500-2700 K by a Transient Interferometric Technique.

Final rept.,
A. P. Miller, and A. Cezairliyan. 1988, 9p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in International Jnl. of Thermophysics 9, n2 p195-203 Mar 88.

Keywords: *Niobium, *Thermal expansion, *Interferometers, Thermophysical properties, Optical measuring instruments, Mathematical models, Temperature measurement, Diffraction, Reprints.

The linear thermal expansion of niobium has been measured in the temperature range 1500-2700 K by means of a transient (subsecond) interferometric technique. The basic method involves rapidly heating the specimen from room temperature up to and through the temperature range of interest in less than 1 s by passing an electrical current pulse through it and simultaneously measuring the specimen temperature by means of high-speed photoelectric pyrometer and the shift in the fringe pattern produced by a Michelson-type interferometer. The linear thermal expansion is determined from the cumulative shift corresponding to each measured temperature.

801,040

PB89-137657 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Ignition Characteristics of Several Alloys for Use in Oxygen Systems.

Final rept.,
 J. W. Bransford, P. A. Billiard, J. A. Hurley, K. M. McDermott, and I. Vazquez. 1988, 28p
 Sponsored by National Aeronautics and Space Administration, Huntsville, AL. George C. Marshall Space Flight Center.
 Pub. in Proceedings of NASA/MSFC Earth-to-Orbit Conference, Huntsville, AL., May 9-13, 1988, 28p.

Keywords: *Alloys, *Combustion, Ignition, Oxidation tests, Corrosion resistant, Pressurizing, Thermal resistant, Reprints.

The development of ignition and combustion in a pressurized oxygen atmosphere was studied for several alloys that are currently used or have potential use in high pressure oxygen systems. Ignition of the alloys was achieved by heating the top surface of cylindrical specimens with a continuous wave CO₂ laser. Laser power was periodically increased until an autoheating condition was established. The procedure allowed the tendency of the alloys to autoheat to destruction to be studied. It was found that all the alloys would autoheat to destruction from temperatures below the solidus temperature. It was also found that endothermic events occurred as the alloys were heated; many were at reproducible temperatures. Many endothermic events tended to accelerate the rate of temperature increase of the specimen under constant laser power. It is suggested that the source of these endotherms may increase the rate of oxidation of the alloy. Ignition parameter temperature data for the alloys are given for the oxygen pressure range of 1.72 MPa to 13.8 MPa.

Wood & Paper Products

801,041
PB88-175583 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Solid State Carbon 13 NMR Determination of Syringyl/Guaiacyl Ratio in Hardwood.
 Final rept.,
 W. F. Manders. 1987, 6p
 Pub. in Holzforschung 41, n1 p13-18 1987.

Keywords: *Hardwoods, *Softwoods, *Wood, Nuclear magnetic resonance, Spectra, Reprints, *Carbon 13, Lignin.

The 13C NMR spectra acquired with cross-polarization, magic angle spinning, and interrupted decoupling techniques of the nonprotonated aromatic region of a hardwood and a softwood pair are deconvoluted to give the syringyl spectrum of the hardwood and the guaiacyl spectrum of the softwood. The deconvolution can be treated quantitatively to yield the molar ratio of syringyl to guaiacyl monomers in the lignin portion of wood. The ratio ranges from 0.94 to 1.60 for the hardwoods, maple, yellow poplar, red oak, and basswood, while an average value of 0.15 is determined for the softwoods, spruce, western red cedar, southern pine, and redwood.

MATHEMATICAL SCIENCES

Algebra, Analysis, Geometry, & Mathematical Logic

801,042
PB88-176599 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Review of Book: Linear Turning Point Theory.
 Final rept.,
 F. W. J. Olver. 1986, 3p
 Pub. in SIAM (Society for Industrial and Applied Mathematics) Review 28, n3 p433-435 Sep 86.

Keywords: Matrices(Mathematics), Differential equations, Error analysis, Reprints, *Turning points, Book reviews, Asymptotic methods.

No abstract available.

801,043
PB88-230461 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Computer Services Div.
Review of Three Tables of H. F. Bauer and W. Eidel.
 Final rept.,
 J. M. Smith. 1988, 2p
 Pub. in Mathematics of Computation 50, n182 p647-648 Apr 88.

Keywords: *Legendre functions, Tables(Data), Tests, Reprints, Bauer H F.

The review reports the method and results of tests performed on three tables of zeros of Legendre functions by H. F. Bauer.

801,044
PB89-124945 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Multiprocessor FFT (Fast Fourier Transform) Methods.
 Final rept.,
 W. L. Briggs, L. B. Hart, R. A. Sweet, and A. O'Gallagher. 1987, 16p
 Pub. in SIAM (Society for Industrial and Applied Mathematics) Jnl. on Scientific and Statistical Computing 8, n1 pS27-S42 Jan 87.

Keywords: *Algorithms, Performance evaluation, Reprints, *Fast Fourier Transformations, Multiprocessors.

Proceeding first by experiment and then by analysis, the problem of implementing FFT algorithms on a shared memory multiprocessor is investigated. Several algorithms for performing a single FFT and multiple FFTs are implemented and compared on the Denelcor HEP computer. These algorithms are then analyzed using performance models which reproduce the experimental timing curves. For both the single and multiple FFT a clear choice of superior algorithms can be made. These algorithms are expected to be useful and to preserve their performance characteristics on other shared memory multiprocessors.

801,045
PB89-129480 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Constructing Delaunay Triangulations for Sets Constrained by Line Segments.
 Technical note (Final),
 J. Bernal. Sep 88, 35p NIST/TN-1252
 Also available from Supt. of Docs. as SN003-003-02893-2.

Keywords: *Algorithms, *Triangulation, Geometry, Mathematical programming, *Delaunay triangulations.

In the paper, the authors propose a simple algorithm for constructing a Delaunay triangulation for a finite set of points in the plane constrained by a finite collection of line segments. The algorithm constructs first a Delaunay triangulation for the set, and then generates from it a sequence of triangulations as each line segment is incorporated into the previously obtained triangulation. An expected time analysis shows the algorithm to be linear if the number of line segments is kept constant.

801,046
PB89-137608 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Languages and Software Parts for Elliptic Boundary-Value Problems.
 Final rept.,
 R. F. Boisvert. 1987, 21p
 Pub. in The Role of Language in Problem Solving 2, p411-431 1987.

Keywords: *Elliptic differential equations, *Computer systems programs, *Languages, Boundary value problems, Reprints, ELLPACK.

Advances in numerical analysis have lead to the development of software for solving increasingly complex mathematical problems. Unfortunately, this has meant

an increase in the complexity of the user interface, especially in the case of subprograms in general-purpose, procedural languages like Fortran where such software is almost exclusively available. As a result, high-level applications-oriented interfaces to such software are beginning to emerge. In the paper authors describe such a system, called ELLPACK, for elliptic boundary-value problems. The ELLPACK system is characterized by a carefully-designed software parts technology for the problem domain combined with a high-level language which allows users to declare problem components using natural mathematical notation and to easily invoke modules for various stages of the solution process. The authors describe how ELLPACK is being used as the kernel for sophisticated problem-solving environments involving graphics workstations, expert systems, and supercomputer networks.

Operations Research

801,047
PB88-198999 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Problem Specification for Linear Programs.
 Final rept.,
 C. Witzgall, and M. A. McClain. 1987, 33p
 Pub. in IMA Jnl. of Mathematics in Management 1, p177-209 1987.

Keywords: *Linear programming, Specification, Reprints, Data bases.

A language for specifying linear programs is proposed. The specification language is designed so as to enable the user to define the input for a particular linear program in terms of a given tabular database consisting of multidimensional tables.

Statistical Analysis

801,048
PB88-174206 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Alternative to Ordinary Q-Q Plots: Conditional Q-Q Plots.
 Final rept.,
 K. Kafadar, and C. H. Spiegelman. 1986, 18p
 Pub. in Comput. Stat. and Data Anal. 4, n3 p167-184 Oct 86.

Keywords: Probability theory, Normal density functions, Reprints, *Q-Q plots, Q Q plots, Robustness (Mathematics).

An ordinary q-q plot has at least two faults: it has a wavy appearance and its degree of linearity is hard to quantify. The authors propose a remedy, called a conditional q-q plot, that reduces the waviness by conditioning on functions of adjacent random variables. It provides an easy and useful plot for assessing the validity of distributional assumptions. Examples are given and discussed.

801,049
PB88-174214 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Semiparametric Approach to Density-Estimation.
 Final rept.,
 I. Olkin, and C. H. Spiegelman. 1987, 8p
 Sponsored by Office of Naval Research, Arlington, VA. Pub. in Jnl. of the American Statistical Association 82, n399 p858-865 1987.

Keywords: *Probability density functions, Nonparametric statistics, Reprints, Maximum likelihood estimation.

The paper provides an adaptive approach for choosing between parametric and nonparametric density estimates. It is based upon a convex combination of the parametric and nonparametric density estimates, and chooses the weight from the data so as to minimize

MATHEMATICAL SCIENCES

Statistical Analysis

the expected loss. The approach is demonstrated by fitting density estimates to two data sets.

801,050

PB88-189923

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

First Passage Time Densities for Random Walk Spans.

Final rept.,

G. H. Weiss, E. A. DiMarzio, and R. J. Gaylord. 1986, 6p

Pub. in Jnl. of Statistical Physics 42, n3-4 p567-572 1986.

Keywords: *Random walk, Laplace transformation, Probability density functions, Reprints, Asymptotic stability.

A general expression is derived for the Laplace transform of the probability density of the first passage time for the span of a continuous-time random walk to reach level S. The authors show that when the mean time between steps is finite, the mean first passage time to S is proportional to S squared. When the pausing time density is asymptotic to a stable density, they show that the first passage density is also asymptotically stable.

801,051

PB89-101422

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD.

Iterative Self-Weighting Procedure for Fitting Straight Lines to Heteroscedastic Data.

Final rept.,

J. Mandel, and F. L. McCrackin. 1988, 27p

Pub. in Communications in Statistics, Simulation 17, n2 p609-635 1988.

Keywords: *Linear regression, Computer programs, Reprints, *Fitting straight lines, *Heteroscedastic errors, US NBS.

An iterative, self-weighting procedure is presented for the fitting of straight lines to data with heteroscedastic error-variances in the response variable. The error-variances are assumed to be unknown, even relative to each other. The procedure is compared with the 'resistant line' method advocated by Emerson and Hoaglin (Emerson and Hoaglin, 1983), using extensive Monte-Carlo calculations. The proposed method is simple and easily automated, and gives parameter-estimates with smaller variance (higher efficiency) than those resulting from the resistant line technique. A BASIC program to perform the self-weighting fit is given in an appendix.

General

801,052

PB89-136543

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Automated Production Technology Div.

Computational Ontology.

Final rept.,

J. C. Boudreaux. 1987, 28p

Pub. in The Role of Language in Problem Solving 2, p133-160 1987.

Keywords: *Computation linguistics, *Conformal mapping, Artificial intelligence, Linguistics, Mathematical logic, Reprints.

In order to automate tasks which bring about actual modifications of the physical universe, systems must have access to representations of common sense knowledge and to inferential rules which allow this knowledge to be applied to specific situations. But common sense knowledge has proven to be highly resistant to algorithmic analysis. An important reason for this is the fact that common sense knowledge presupposes an elaborate theory of mid-sized (macroscopic) objects. The topic is a very important theme of an ancient philosophic discipline called ontology. The paper adopts the ontological methods of Carnap by reducing questions about the general structure of common sense knowledge to more readily answerable questions about the structure of linguistic frameworks. Though these issues are inherently abstract, requiring thorough acquaintance with the formal techniques of

mathematical logic, the main contribution of the paper will be the presentation of linguistic frameworks as executable models in FranzLISP.

MEDICINE & BIOLOGY

Biochemistry

801,053

PB88-175161

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Formation of Radiation-Induced Crosslinks between Thymine and Tyrosine: A Possible Model for the Crosslinking of DNA (Deoxyribonucleic Acid) and Proteins by Ionizing Radiation.

Final rept.,

M. G. Simic, and M. Dizdareglu. 1985, 4p

Pub. in Biochemistry 24, n1 p233-236 1985.

Keywords: Fragmentation, Histones, Reprints, *Protein crosslinks, *Deoxyribonucleic acids, OH radicals, Rate constants.

A model for radiation-induced crosslinking of DNA and proteins has been developed. It is based on initial formation of free radicals on a DNA base, i.e., thymine, and on an amino acid, i.e., tyrosine. It was demonstrated that interaction of these radicals is highly favored as measured by their kinetics and the crosslinked products. The GC-MS methodology used for the identification of the thymine-tyrosine crosslinks is suggested as an experimental approach in the measurements of biological crosslinks.

801,054

PB88-175237

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Two-Photon Laser-Induced Fluorescence of the Tumor-Localizing Photosensitizer Hematoporphyrin Derivative - Resonance-Enhanced 750 nm Two-Photon Excitation into the Near-UV Soret Band.

Final rept.,

R. S. Bodaness, D. F. Heller, J. Krasinski, and D. S. King. 1986, 4p

Pub. in Jnl. of Biological Chemistry 261, n26 p2098-2101 1986.

Keywords: *Fluorescence, Hematoporphyrin derivative, Photodynamic therapy, Photooxidation, Photosensitizer, Reprints, *Alexandrite laser, Two photon.

The tumor localizing photosensitizer hematoporphyrin derivative is shown to undergo a simultaneous two-phase excitation into the 365 nm Soret absorption band system upon intense laser irradiation at 750 nm. There is no significant one-photon absorbance by HPD of 750 nm photons in aqueous solution. Subsequent to this excitation, internal conversion and vibrational relaxation occur, resulting in the population of the vibrationless level of the first electronically excited singlet state. The state relaxes by two channels, the emission of fluorescence in the spectral region 600 to 750 nm, and intersystem crossing into the triplet manifold. Evidence for the two-photon excitation consists in the observation both of fluorescence emission at 615 nm as a result of 750 nm excitation and the quadratic dependence of the fluorescence emission intensity upon the excitation laser intensity. Since the penetration depth of ultraviolet and visible light into tissue varies directly with wavelength (i.e., red penetrates deeper than blue) these studies suggest the possibility that two-photon induced localization of tumor-bound HPD might facilitate the detection of deeper lying tumors that allowed by the current one-photon method.

801,055

PB88-193743

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.

Strategy for Making Enzyme Reference Materials Available.

Final rept.,

S. D. Rasberry. 1985, 6p

Pub. in Proceedings of Workshop on Reference System for Clinical Enzymology, Arlington, VA., October 16-17, 1985, p167-172.

Keywords: *Enzymes, Quality control, *Standard Reference Materials.

The paper provides a brief statement of general aspects regarding Reference Materials: definitions, certification, and use. Then it focuses these aspects to a specific strategy for making enzyme reference materials available.

801,056

PB88-194022

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.

Overview of a National Reference System.

Final rept.,

H. S. Hertz. 1985, 10p

Sponsored by National Committee for Clinical Lab. Standards, Villanova, PA.

Pub. in Proceedings of Workshop on A Reference System for Clinical Enzymology, Arlington, VA., October 16-17, 1985, p1-10.

Keywords: *Enzymology, *Clinical enzymology, *Reference systems.

Great progress has been achieved since the Conference on a National Understanding for the Development of Reference Materials and Methods for Clinical Chemistry held in Atlanta in November 1977. This is an appropriate time, as the authors begin to explore the feasibility of a reference system for clinical enzymology, to review progress and accomplishments of the National Reference System for the Clinical Laboratory and to examine the role which definitive methods, reference methods, and reference materials play in this system. To set an appropriate context for this review important characteristics of chemical measurements are discussed. Then the interrelationships and progress in developing the three key components of an accuracy-based measurement system: definitive and reference methods and reference materials, are presented. Finally, critical questions to be answered in developing a national reference system for clinical enzymology are posed.

801,057

PB88-204466

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Crystallization of a DNA Duplex 15-mer Containing Unpaired Bases: d(CGCGAAATTTACGCG).

Final rept.,

M. Miller, A. Wlodawer, E. Appella, and J. L. Sussman. 1987, 2p

Pub. in Jnl. of Molecular Biology 195, p967-968 1987.

Keywords: *Deoxyribonucleic acids, Nucleic acids, Molecular structure, Crystallization, Reprints, *DNA.

Crystals of an almost self-complementary DNA 15 mer d(CGCGAAATTTACGCG) have been grown by the vapor diffusion technique at 4 deg C. The space group is I222 with a = 37.3 Angstroms, b = 54.6 Angstroms and c = 104.8 Angstroms. Solution studies showed that the 15 mer forms a duplex with the extra adenine residue unpaired. Crystals are stable at 4 deg C and are suitable for medium resolution structural studies.

801,058

PB88-209432

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Mechanism of Oligonucleotide Loop Formation In Solution.

Final rept.,

S. Roy, S. Weinstein, B. Borah, J. Nickol, E. Appella, J. L. Sussman, M. Miller, H. Shindo, and J. S. Cohen. 1986, 7p

Supersedes PB87-218954.

Pub. in Biochemistry 25, n23 p7417-7423, 18 Nov 86.

Keywords: *Deoxyribonucleic acid, Thermodynamics, Reprints, *Oligonucleotides, Nuclear magnetic resonance, Duplex.

The authors have studied the tridecadeoxynucleotide CGCGAATTACGCG (1), which contains an additional A at position 9 compared to the dodecanucleotide of which the crystal structure has been determined. Sequence 1 exhibits no distinct melting curve and also has a concentration-dependent pattern of peaks on reverse-phase chromatography. This behavior is explained by a slow equilibration between loop and duplex forms in solution. The authors have characterized this equilibrium by proton NMR spectroscopy and

shown that it is fully reversible by monitoring the two thymine methyl resonances, each of which occurs in two environments. Lower temperature and higher concentration favor the duplex; the midpoint of the transition is such that the loop predominates at room temperature. The authors have measured the van't Hoff enthalpy of formation of the duplex and the activation energy by temperature-jump and saturation-transfer experiments. The results are compared with those for the 17-mer sequence CGCGGAATTACGCGCG (II), which contains two additional base pairs in the stem of the loop. The thermodynamic parameters and the effect of increasing salt concentration on the rate of conversion of the loop and duplex forms lead the authors to presume that the mechanism of interconversion involves complete strand separation and re-formation rather than cruciform formation and branch migration.

801,059
PB88-218169 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Total Reflection Energy-Dispersive X-ray Fluorescence Spectrometry Using Monochromatic Synchrotron Radiation: Application to Selenium in Blood Serum.
Final rept.,
P. A. Pella, and R. C. Dobbins. 1988, 4p
Pub. in *Analytical Chemistry* 60, n7 p684-687, 1 Apr 88.

Keywords: *Blood serum, *Spectroscopic analysis, *Selenium, X ray fluorescence, Blood chemical analysis, Synchrotrons, Monochromatic radiation, Excitation, Metals, Trace elements, Sensitivity, Concentration(Composition), Reprints.

Monochromatic synchrotron X-radiation at The National Synchrotron Light Source (NSLS) has been investigated as an excitation source for the direct energy-dispersive X-ray fluorescence (EDXRF) spectrometric analysis of metals in solution at parts per billion (ppb) levels in the total reflection geometry. A minimum detection limit (mdl) of 8 ppb was determined for selenium in human blood serum and in proposed NBS-SRM 1598 bovine serum. The results show that this method is sufficiently sensitive for analysis of Se in blood serum. Minimum detection limits were also calculated to compare relative sensitivities of tube-excited secondary target conventional sources when illuminating a large sample area with NSLS excitation when probing a much smaller sample area.

801,060
PB88-230289 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Thermodynamics of Hydrolysis of Sugar Phosphates.
Final rept.,
Y. B. Tewari, D. K. Steckler, R. N. Goldberg, and W. L. Gitomer. 1988, 6p
Pub. in *Jnl. of Biological Chemistry* 263, n8 p3670-3675, 15 Mar 88.

Keywords: *Thermodynamics, *Hydrolysis, Calorimeters, Chemical equilibrium, Enthalpy, Entropy, Ions, Concentration(Composition), Reprints, *Sugar phosphates, Phosphoric acid/glucosyl-ester, Phosphoric acid/mannosyl-ester, Phosphoric acid/fructosyl-ester, Phosphoric acid/ribosyl-ester, Phosphoric acid/ribulose-5-phosphate.

The thermodynamics of the enzyme-catalyzed (alkaline phosphatase, EC 3.1.3.1) hydrolysis of glucose 6-phosphate, mannose 6-phosphate, fructose 6-phosphate, ribose 5-phosphate, and ribulose 5-phosphate have been investigated using microcalorimetry and, for the hydrolysis of fructose 6-phosphate, chemical equilibrium measurements. Results of these measurements for the processes sugar phosphate(2-) (aqueous) + H₂O (liquid) = sugar (aqueous) + HPO₄(2-) (aqueous) at 25 C follow: DeltaHsup0 = 0.91 + or - 0.35 kJ/mol and DeltaCsubp, sup0 = -48 + or - 18 J/mol/K for glucose 6-phosphate; DeltaCsubp, sup0 = 1.40 + or - 0.31 kJ/mol and DeltaCsubp, sup0 = -46 + or - 11 J/mol/dK for mannose 6-phosphate; DeltaHsup0 = -13.70 + or - 0.28 kJ/mol DeltaHsup0 = -7.61 + or - 0.68 kJ/mol, and DeltaCsubp, sup0 = -28 + or - 42 J/mol/K for fructose 6-phosphate; DeltaHsup0 = -5.69 + or - 0.52 kJ/mol and DeltaHsup0 = -63 + or - 37 J/mol/K for ribose 5-phosphate; and DeltaHsup0 = -12.43 + or - 0.45 kJ/mol and DeltaCsubp, sup0 = -84 + or - 30 J/mol/K for the hydrolysis of ribulose 5-phosphate. The standard state is the hypothetical ideal solution of unit molality. Estimates are

made for the equilibrium constants for the hydrolysis of ribose and ribulose 5-phosphates. The effects of pH, magnesium ion concentration, and ionic strength on the thermodynamics of these reactions are considered.

801,061
PB88-230362 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Thermodynamics of Isomerization Reactions Involving Sugar Phosphates.
Final rept.,
Y. B. Tewari, D. K. Steckler, and R. N. Goldberg. 1988, 6p
Pub. in *Jnl. of Biological Chemistry* 263, n8 p3664-3669, 15 Mar 88.

Keywords: *Thermodynamics, *Isomerization, Calorimeters, Chemical equilibrium, Enthalpy, Entropy, Reprints, *Sugar phosphates, Phosphoric acid/glucosyl-ester, Phosphoric acid/fructosyl-ester, Phosphoric acid/mannosyl-ester, Phosphoric acid/ribulose-5-phosphate, Phosphoric acid/ribosyl-ester.

The thermodynamics of isomerization reactions involving sugar phosphates have been studied using heat-conduction microcalorimetry. For the process glucose 6-phosphate(2-) (aqueous) = fructose 6-phosphate(2-) (aqueous), K = 0.285 + or - 0.004, DeltaGsup0 = 3.11 + or - 0.04 kJ/mol, DeltaHsup0 = 11.7 + or - 0.2 kJ/mol, and DeltaCsubp, sup0 = 44 + or - 11 J/mol/K at 298.15 K. For the process mannose 6-phosphate(2-) (aqueous) = fructose 6-phosphate(2-) (aqueous), K = 0.99 + or - 0.05, DeltaGsup0 = 0.025 + or - 0.13 kJ/mol, DeltaHsup0 = 8.46 + or - 0.2 kJ/mol, and DeltaCsubp, sup0 = 38 + or - 25 J/mol/K at 298.15 K. The standard state is the hypothetical ideal solution of unit molality. An approximate result (-14 + or - 5 kJ/mol) was obtained for the enthalpy of isomerization of ribulose 5-phosphate (aqueous) to ribose 5-phosphate (aqueous). The data from the literature on isomerization reactions involving sugar phosphates have been summarized, adjusted to a common reference state, and examined for trends and relationships to each other and to other thermodynamic measurements. Estimates are made for thermochemical parameters to predict the state of equilibrium of the several isomerizations considered herein.

801,062
PB89-123285 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Modulation of Calcium Phosphate Formation by Phosphatidate-Containing Anionic Liposomes.
Final rept.,
E. D. Eanes, A. W. Hailer, and B. R. Heywood. 1988, 9p
Sponsored by National Inst. of Dental Research, Bethesda, MD, and National Institutes of Health, Bethesda, MD.
Pub. in *Calcified Tissue International* 43, p226-234 1988.

Keywords: *Lipids, *Phosphatidic acids, *Calcium phosphates, *Liposomes, Membranes, Precipitation(Chemistry), Reprints, Mineralization, Dioleoylphosphatidic acid.

Liposomes prepared from 7:2:1 molar mixtures of phosphatidylcholine, dicetyl phosphate, and cholesterol to which 1-20 mole % dioleoylphosphatidic acid (DOPA) was added were used to examine the effect of membrane-bound monoester phosphatidate phosphate anions on calcium phosphate formation in aqueous solutions at 22 deg C, pH 7.4, and 240 mOsm. Results showed that up to 20 mole % DOPA in the liposomal envelope did not initiate mineralization in solutions made metastable with 2.25 mM CaCl₂ and 1.50 mM KH₂PO₄. Results also revealed that precipitation induced in metastable solutions by the seeding action of intraliposomally formed mineral was measurably reduced with as little as 1 mole % DOPA and completely suppressed with 5 mole % DOPA. In contrast, 10 mole % concentrations of diester phosphate lipids either had no effect on extraliposomal precipitation (e.g., phosphatidylglycerol and phosphatidylinositol) or, as reported previously for phosphatidylserine, only partially reduced the amount of precipitate formed. Transmission electron microscopical analysis suggests that DOPA-containing lipid bilayers adhering to the seed crystals inhibited extraliposomal mineralization by encapsulating the crystals within the liposomes and/or by blocking potential growth sites on the crystal faces.

Botany

801,063
PB88-176706 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Physicochemical Characterization of Cardiovascular Calcified Deposits. 1. Isolation, Purification and Instrumental Analysis.
Final rept.,
B. Tomazic, W. E. Brown, L. A. Gual, and M. Sadovnik. 1988, 15p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in *Atherosclerosis* 69, p5-19 1988.

Keywords: Reprints, *Atherosclerotic calcification, *Bioprosthetic calcification, Carbonate apatite, Infra-red spectroscopy, Octacalcium phosphate.

Calcified human aortic atherosclerotic deposits and calf ventricular assist device bioprosthetic deposits were isolated and deproteinized by hydrazine treatment. Detailed chemical and instrumental analyses were applied to gain comprehensive physicochemical information which makes possible establishing compositional and structural similarities between the 2 types of pathologic mineral deposits which form on different host surfaces. These microcrystalline deposit materials are morphologically very heterogeneous and can be represented chemically as carbonate substituted apatite which, in some of its properties, significantly differs from hydroxyapatite. It is indicated that the mechanism for the formation of cardiovascular deposits proceeds through hydrolysis of octacalcium phosphate precursor.

Clinical Chemistry

801,064
PB88-176441 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Determination of Chromium-50 in Human Blood and Its Utilization for Blood Volume Measurements.
Final rept.,
R. Zeisler, and I. Young. 1987, 9p
Pub. in *Jnl. of Radioanalytical and Nuclear Chemistry* 113, n1 p97-105 1987.

Keywords: *Chromium, Blood, Humans, Erythrocytes, Reprints, *Blood chemical analysis, Isotope dilution analysis, Neutron activation analysis.

Possible relationships between insufficient blood volume increases during pregnancy and infant mortality could be established with an adequate measurement procedure. An accurate and precise technique for blood volume measurements has been found in the isotope dilution technique using chromium-51 as a label for red blood cells. However, in a study involving pregnant women, only stable isotopes can be used for labeling. Stable chromium-50 can be determined in total blood samples before and after dilution experiments by neutron activation analysis (NAA) or mass spectrometry. However, both techniques may be affected by insufficient sensitivity and contamination problems at the inherently low natural chromium concentrations to be measured in the blood. NAA procedures involving irradiations with highly thermalized neutrons at a fluence rate of 2 x 10 to the 13th power ncm(-2)s(-1) and low background gamma spectrometry are applied to the analysis of total blood. Natural levels of chromium-50 in human and animal blood have been found to be < 0.1 ng/ml; i.e., total chromium levels of < 3 ng/ml. Based on the NAA procedure, a new approach to the blood volume measurement via chromium-50 isotope dilution has been developed which utilizes the ratio of the induced activities of chromium-51 to the iron-59 in three blood samples taken from each individual, namely blank, labeled and diluted labeled blood.

801,065
PB88-217864 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

MEDICINE & BIOLOGY

Clinical Chemistry

How and Why of an Accuracy Base for Proficiency Testing Programs.

Final rept.,
M. J. Welch, and H. S. Hertz. 1988, 3p
Pub. in Archives of Pathology and Laboratory Medicine 112, p343-345 Apr 88.

Keywords: *Standards, *Blood serum, *Clinical medicine, Concentration(Composition), Samplers, Isotopic labeling, Calcium, Potassium, Chlorides, Cholesterol, Glucose, Urea, Uric acid, Dilution, Reprints, *Clinical analysis, *Reference materials.

The College of American Pathologists operates a major proficiency testing program for clinical laboratories. The National Bureau of Standards works with the College of American Pathologists to assign values for analyte concentrations in proficiency testing samples where possible, and these values are used to assess the overall accuracy of the participants (grand mean) as well as the accuracy of peer groups (those that use the same methodology and/or instrumentation). To illustrate the definitive method development process, a modified and improved definitive method for cholesterol measurement is described. The modified method uses a cholesterol (13)C3 as the labeled internal standard, capillary gas chromatography for sample introduction, and a novel means of electrically switching between the ions being measured. Results on standard reference material 909, a lyophilized human serum, demonstrate the precision and absence of significant measurement bias attainable with the new method.

801,066
PB88-217914 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Liposome-Enhanced Flow Injection Immunoanalysis.
Final rept.,
A. L. Plant, L. Locascio-Brown, M. V. Brizgys, and R. A. Durst. 1988, 4p
Pub. in Bio/Technology 6, p266-269 Mar 88.

Keywords: Antigens, Antibodies, Fluorescence, Adsorption, Reprints, *Clinical analysis, *Flow injection immunoassay, *Immunoanalysis, *Liposome, Immobilization, Immuno reactor.

The development of a repetitive immunoassay is important for monitoring and feedback control in bioprocessing. It is essential that this assay be fast and that the immunoreactor, which uses immobilized antibodies, be regenerable. In the paper, the automated system employs flow injection analysis for solution manipulation. This system contains an immunoreactor column with covalently bound Fab' fragments. Recognition of the antigen is through competitive binding on this column of sample antigen and antigen which is contained in the membrane of liposomes. The concentration of sample antigen is proportional to the amount of liposomes which are competitively excluded from the column. In the flow injection immunoassay, the detection is through a fluorescent marker, carboxy-fluorescein. When liposomes are excluded from the column in the competitive assay, they flow downstream where they are chemically disrupted, and the contents measured.

801,067
PB89-133367 PC A04
National Inst. of Standards and Technology, Gaithersburg, MD.
Journal of Research of the National Institute of Standards and Technology. Volume 93, Number 6, November-December 1988.
1988, 57p
Also available from Supt. of Docs. as SN703-027-00025-3. See also PB89-133375 through PB89-133409 and PB88-246707.

Keywords: *Kinetics, *Energy transfer, *Immunoenzyme techniques, *Chemical analysis, *Immunoassay, *Phenoytoin, *Supercritical fluid chromatography.

Articles in the journal are: Kinetic studies using a highly-sensitive microphone detector; solvent-free injection in supercritical fluid chromatography using sintered glass deposition; Enzyme-enhanced electrochemical immunoassay for phenytoin; Liposome-based flow injection immunoassay system.

801,068
PB89-133391 (Order as PB89-133367, PC A04)
Research Triangle Inst., Research Triangle Park, NC.

Enzyme-Enhanced Electrochemical Immunoassay for Phenytoin,

M. Umana, J. Walker, M. Wani, C. Whisnant, and E. Cook. 1988, 3p
Included in Jnl. of Research of the National Institute of Standards and Technology, v93 n6 p659-661 1988.

Keywords: *Phenytoin, *Immunoenzyme techniques, *Electrochemistry, *Chemical analysis, Glucose oxidase, Ferrocenes, Pyrroles, Electron transfer.

An important application of enzyme-mediated electrocatalysis is in immunoassays where the current amplification of the enzyme reaction enhances the sensitivity of the measurement. The immunological utility of the ferrocene/glucose oxidase (Fer/GOx) system has been demonstrated. Fer-antigen (Ag) is competitively displaced from the antibody (Ab) by Ag, the analyte, and it is determined as an enzyme-amplified oxidation current. The current paper describes experiments aimed at understanding the kinetics and mechanism of the reaction, at determining the optimum conditions for the assay and at testing the generality of the system. Phenytoin was chosen as the model antigen. The paper also describes preliminary results on the electron-transfer mediation of Fer derivatives to polypyrrole-immobilized GOx. The goal of the experiments is to couple the polypyrrole-immobilized GOx to the Fer-phenytoin system to produce a reagentless electrochemical immunoassay sensor, so that easy real-time determinations may be realized.

801,069
PB89-133409 (Order as PB89-133367, PC A04)
National Inst. of Standards and Technology, Gaithersburg, MD.

Liposome-Based Flow Injection Immunoassay System.
L. Locascio-Brown, A. L. Plant, and R. A. Durst. 1988, 3p
Included in Jnl. of Research of the National Institute of Standards and Technology, v93 n6 p663-665 1988.

Keywords: *Immunoassay, *Liposomes, *Fluorescent dyes, *Chemical analysis, Phospholipids, Fluid flow, *Flow injection analysis.

A novel flow injection analysis system that contains an immunospecific reactor column and utilizes liposomes for detection is being developed. The fluorophore-loaded liposomes can provide signal enhancement 1,000 - 1,000,000 times per binding event making fluorescent assays competitive in sensitivity with radioimmunoassays. Liposomes are prepared from a mixture of dimyristoylphosphatidylcholine, dicetyl phosphate and cholesterol. Carboxyfluorescein (CT) is encapsulated in each liposome when the liposomes are formed in CF solution. The liposomes are sensitized to a particular antigen (Ag) through covalent binding of the Ag to the polar head group of a phospholipid molecule. The combining of Ag on the liposomes with antibody (Ab) is monitored through the fluorescence of the encapsulated marker molecule. The liposomes are stable for over 3 months in buffer at room temperature. The flow injection system contains a glass reaction column, nonporous glass beads as solid phase and Ab covalently bound to the solid support.

Clinical Medicine

801,070
PB88-201587 PC A04/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Dosimetry for High Dose Applications.
Special pub. (Final),
J. C. Humphreys, D. Hocken, and W. L. McLaughlin. Mar 88, 52p NBS-P-250/11
Also available from Supt. of Docs. See also PB86-246162. Library of Congress catalog card no. 88-600506.

Keywords: *Calibrating, Standards, *Dosimeter calibration, Ionizing radiation, National Bureau of Standards.

The document describes calibration services available at the National Bureau of Standards for the standardization of high absorbed dose measurements of ionizing radiation. The areas of application of such meas-

urements include medical product sterilization, electronic device radiation hardness testing and food processing. Detailed descriptions of the NBS dosimetry procedures and uncertainty assessments are given. Measurement assurance program techniques are discussed.

Cytology, Genetics, & Molecular Biology

801,071
PB88-175310 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Introduction to Mechanisms of DNA (Deoxyribonucleic Acid) Damage and Repair.
Final rept.,
M. G. Simic. 1986, 8p
Pub. in Basic Life Sciences, Mech. DNA Damage Repair 38, p1-8 1986.

Keywords: *Deoxyribonucleic acid, Mechanisms, Repair, Reprints, *Radiation damage.

An overview of mechanisms of damage and repair associated with DNA-protein complex is presented, as an introduction to the published proceedings of the conference 'Mechanisms of DNA Damage and Repair' held at NBS June 2-7, 1985. Special emphasis was given to free radical processes and the relationship between radiation and chemically induced free radicals. Concept of single damaged and multiple damage sites has been highlighted.

801,072
PB88-175336 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Free Radical Mechanisms of DNA (Deoxyribonucleic Acid) Base Damage.
Final rept.,
M. G. Simic, and S. V. Jovanovic. 1986, 11p
Pub. in Basic Life Sciences, Mech. DNA Damage Repair 38, p39-49 1986.

Keywords: *Deoxyribonucleic bases, Mechanisms, Radiation chemistry, Repair, Reprints, Damage, *Free radicals.

Mechanisms of free radical processes associated with thymine and guanine as the representatives of pyrimidines and purines is reviewed. The derived mechanisms are based on pulse radiolysis and product analysis of aqueous solutions of the two bases and their derivatives. Novel redox processes in radical-radical and radical-redox agent reactions are discussed.

801,073
PB88-176631 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Measurement of Liposome-Released Ferrocyanide by a Dual-Function Polymer Modified Electrode.
Final rept.,
R. M. Kannuck, J. M. Bellama, and R. A. Durst. 1988, 6p
Pub. in Analytical Chemistry 60, n2 p142-147, 15 Jan 88.

Keywords: *Phospholipid vesicles, *Liposomes, *Voltammetry, Reprints, *Polymer modified electrodes.

Potassium ferrocyanide is encapsulated in the aqueous cavity of spherical phospholipid bilayer vesicles (liposomes) at concentrations of approximately 10 to the 4th power molecules/liposome. Physical parameters and stability of these structures are determined by electrochemical and spectroscopic methods. The electroactive marker ions (ferrocyanide) are released from within the liposome by either the addition of surfactant or the complement lysis of the membrane. The classical complement pathway is an antigen/antibody-specific reaction that occurs when an antigen-sensitized liposome immunospecifically binds with a corresponding antibody in the presence of certain serum proteins (complement). The release of encapsulated ferrocyanide is monitored by differential pulse voltammetry. Preliminary investigations with an ion-exchange polymer modified electrode demonstrate the ability to

preconcentrate the released marker at the electrode surface as well as the necessity of a polymer film to protect the surface from fouling during serum-mediated lysis.

801,074
PB88-189683 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Preliminary Crystallographic Study of an L-Asparaginase from 'Vibrio Succinogenes'.
Final rept.,
H. L. Ammon, K. C. Murphy, K. Chandrasekhar, and A. Wlodawer. 1985, 3p
Pub. in Jnl. of Molecular Biology 184, n1 p179-181 1985.

Keywords: Crystals, Reprints, *Asparaginase, Molecular symmetry, *Protein structure, Rotation function, X ray diffraction.

Crystals of an L-asparaginase from *Vibrio succinogenes* were obtained with the hanging drop method from ammonium sulphate-containing solutions. The crystals belong to the orthorhombic space group P2(1)2(1) with unit cell dimensions of $a = 7.3$, $b = 85.8$, $c = 114.0$ Å, and contain two tetrameric enzyme molecules per unit cell. There are two subunits in the asymmetric unit; a molecular dyad is coincident with the crystallographic dyad. The crystal lattice is similar to that reported for an *E. coli* asparaginase. Rotation functions calculations have revealed that the *V. succinogenes* enzyme has 222 point group symmetry in the crystal. The second and third molecular dyads differ, however, from the corresponding *E. coli* asparaginase dyads by ca. 40 degs. The crystals diffract to at least 2.2 Å resolution and are suitable for X-ray crystallographic structure determination.

801,075
PB88-189709 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Crystallization of rec A Protein from Proteus Mirabilis.
Final rept.,
I. T. Weber, and T. A. Steitz. 1986, 2p
Pub. in Jnl. of Molecular Biology 188, n1 p109-110 1986.

Keywords: *Biochemistry, *Crystallization, Reprints, DNA repair, *Proteus mirabilis*, *rec A protein, X ray diffraction.

The rec A protein from *proteus mirabilis*, which is homologous to the *E. coli* protein, forms crystals in the orthorhombic space group P2(1)2(1)2(1). There are two 38000 molecular weight subunits in the asymmetric unit and the unit cell dimensions are: $a = 57.5$, $b = 127.0$ Å and $c = 157.0$ Å.

801,076
PB89-127039 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Crystallization and Preliminary X-ray Diffraction Studies of Subtilisin GX from Bacillus sp. GX6644.
Final rept.,
G. L. Gilliland, A. J. Howard, E. L. Winborne, T. L. Poulos, D. B. Stewart, and D. B. Stewart. 1987, 4p
Pub. in Jnl. of Biological Chemistry 262, n9 p4280-4283 1987.

Keywords: *Bacillus, *Subtilisins, *X-ray diffraction, Crystallization, Reprints.

Subtilisin GX, a serine protease from *Bacillus* species GX6644, has been crystallized by the method of vapor diffusion using ammonium sulfate as the precipitant. The space group is P2(sub 1)2(sub 1)2(sub 1) with $a = 38.4$ Å, $b = 70.3$ Å, $c = 73.5$ Å and one molecule in the asymmetric unit. The crystals diffract to beyond 2.0 Å resolution and are suitable for a high resolution three-dimensional structure determination. All x-ray data used in the preliminary crystallographic study were collected with an electronic area detector.

Dentistry

801,077
PB88-175682 Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Microanalytical Determination of pH, Calcium, and Phosphate In Plaque Fluid.

Final rept.,
C. A. N. Rankine, E. C. Moreno, G. L. Vogel, and H. C. Margolis. 1985, 6p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 64, n11 p1275-1280 1985.

Keywords: *Calcium, *Fluid, Microanalysis, pH, Phosphate, Plaque, Reprints.

Microanalytical techniques for the analysis of calcium, phosphorus and pH in small volumes (approx. 60 nL) of plaque fluid are described and evaluated. The accuracy and the precision of the techniques were compared to standard macrotechniques using a large pooled plaque fluid sample. The results obtained for the microanalysis of pooled plaque fluid were in excellent agreement with those obtained by macromethods. The described techniques were also used to analyze plaque fluid obtained from single quadrants of the oral cavity of five individuals. In this fashion it was determined that although a significant variation in plaque fluid composition exists between the quadrants, a greater variation exists between subjects. Analyses of plaque fluid obtained from six individuals, following sucrose exposure, were also conducted. The pH value of the fluid changed with time, following a typical Stephan curve with a minimum value occurring between fifteen and thirty minutes; following this, the pH increased to a value near that for resting plaque. An inverse relationship between pH and calcium and phosphorus concentrations was observed. It is noted that the described techniques are sensitive enough to both accurately and precisely carry out the above analyses using plaque obtained from a single quadrant.

801,078
PB88-175724 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Bond Strength of a Luting Composite to Dentin with Different Bonding Systems.
Final rept.,
B. P. O'Sullivan, P. F. Johnson, R. L. Blosser, N. W. Rupp, and S. H. Li. 1987, 5p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Prosthetic Dentistry 58, n2 p171-175 1987.

Keywords: Reprints, *Cohesive failure, *Dentin bond, FNP bonding system, Resin bonded bridge.

The stability of the resin bonded bridge depends on a resin bond to metal and to tooth. The cohesive strength of the resin is also a factor. In the event the tooth tissue exposed for bonding is dentin, a secure dentin bond is required. Two such dentin bonding systems were used in the study. Only the FNP system maintained a bond after thermal cycling (5 to 55 C) for 24 hours.

801,079
PB88-176664 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Adsorption of N-phenylglycine on Hydroxyapatite: Role In the Bonding Procedure of a Restorative Resin to Dentin.
Final rept.,
D. N. Misra, and A. D. Johnston. 1987, 11p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Biomedical Materials Research 21, p1329-1339 1987.

Keywords: Reprints, *Adsorption isotherm, *Dental bonding, Diametral tensile strength, Langmuir plot, Phenylglycine.

The adsorption of N-phenylglycine (NPG) onto synthetic hydroxyapatite from ethanol solutions was studied to elucidate the role of surface-active moieties in determining the character of adsorption, and to explore the role of NPG in a bonding procedure of restorative resin to dentin. The adsorption isotherm of N-phenylglycine is reversible (and langmuirian) from ethanol (99.8%). At maximum adsorption the phenyl rings of the adsorbed molecules lie flat on the surface and the carboxylate oxygens and amino nitrogens are anchored to the surface. The N-phenylglycine serves as

an amine accelerator since the peroxide containing monomer polymerizes with the adsorbate-covered apatite. The diametral tensile strength of the composite is approximately equal to the composite filled with untreated apatite. The role of various factors contributing to adhesive strength in the bonding procedure is also discussed.

801,080
PB88-176672 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Casting of Dental Alloys: Mold and Alloy Temperature Effects.
Final rept.,
S. Hirano, J. Tesk, R. Hinman, H. Argentar, and T. Gregory. 1987, 8p
Pub. in Dental Materials 3, p307-314 1987.

Keywords: Alloys, Measurement, Temperature effects, Reprints, *Dental castings, *Castability.

A casting monitor consisting of a square polyester grid pattern was used to evaluate the casting behavior of 6 non-precious dental casting alloys. A castability value, Cv, was determined and is defined as the fraction or percentage of cast grid segments. The dependence of Cv on the alloy superheat casting temperature, Ta, and mold temperature, Tm, was evaluated. It was found that the standard deviation (SD) of Cv was dependent on Cv. For curve fitting, a transformation, Cv,t, of Cv was used such that the SD(Cv,t) not equal to f(Cv,t). It was found that a single equation was capable of representing Cv,t for all 6 dental alloys at the 95% confidence level: $Cv,t = a + bTa(1/2)Tm2$. The expression has many potential uses for alloy design, product quality assurance and dental laboratory casting control.

801,081
PB88-176680 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Dentine and Enamel Bonding Agents.
Final rept.,
R. L. Bowen, M. S. Tung, R. L. Blosser, and E. Asmussen. 1987, 4p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in International Dental Jnl. 37, p158-161 1987.

Keywords: *Adhesion, *Aluminum nitrate, *Dentin, Enamel, Reprints, Aluminum oxalate, *Restorative dentistry.

The rationale for the use of ferric oxalate (FO) solutions as a mordant step in promoting adhesive bonding of composites to dentine and enamel (Bowen et al., 1982; 1984b; Bowen, 1985) included the following: ferric oxalate (FO), although slow to dissolve, has high solubility in water and the reaction products of its solution applied to dentine or enamel should include insoluble calcium oxalate and practically insoluble ferric phosphate. These insoluble reaction products could at least partially obturate the lumina of dentinal tubules to aid in the protection of vital pulp tissues. The present study explores the feasibility of substituting aluminium ions for ferric ions and of simplifying the procedure. Aluminium ions obviate the formation of ferrous sulphide or other iron compounds which might lead to marginal staining under oral conditions.

801,082
PB88-176698 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
New Calcium Phosphate, Water-Setting Cement.
Final rept.,
W. E. Brown, and L. C. Chow. 1987, 29p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Cements Research Progress 1986, p351-379 1987.

Keywords: *Cements, Reprints, *Calcium phosphate, *Dicalcium phosphates, Hydroxyapatite, Tetracalcium phosphate, Water.

A new calcium phosphate cement is described which is unique because, when set, it has a structure and composition similar to hydroxyapatite, Ca5(PO4)3OH, the mineral in teeth and bones. Before it is mixed with water, the primary reactants in the dry powder are tetracalcium phosphate, Ca4(PO4)2O and either dicalcium phosphate dihydrate, CaHPO4.2H2O, or anhydrous dicalcium phosphate, CaHPO4. The cement is

unique because apatitic nature of the set cement makes it highly compatible with soft and hard tissues. Its properties indicate that it should have many applications in dental and medical practice. In addition to its use as a setting cement, it has potential use as a mineralizer of incipient caries lesions in teeth. The relatively low cost of its ingredients indicates that it should have many applications outside the health field.

801,083

PB88-176722 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Vanillate and Syringate Cements.

Final rept.,
G. M. Brauer. 1988, 1p
Pub. in Trends and Techniques 5, n1 p6 Jan/Feb 88.

Keywords: *Cements, Reprints, *Syringate cements, *Vanillate cements.

The properties of an improved cement developed at NBS are described. This material based on hexyl vanillate ester dissolved in o-ethoxybenzoic acid and zinc oxide is stronger and less soluble than commonly used zinc oxide-eugenol dental cements. The vanillate cement does not inhibit polymerization. The cured material adheres strongly to resins, non-precious metals and ceramics. It is non-toxic and its excellent biocompatibility has been established. Because of these advantages the material should find many applications in clinical dentistry.

801,084

PB88-189956 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Microradiography with an X-ray Image Magnifier: Application to Dental Hard Tissue.

Final rept.,
M. Kuriyama, R. C. Dobbyn, S. Takagi, and L. C. Chow. 1987, 7p
Sponsored by Public Health Service, Rockville, MD.
Pub. in Medical Physics 14, n6 p968-974 Nov/Dec 87.

Keywords: Reprints, Parallel beam microradiography, *X ray image magnification, Dental microradiography, *Dental hard tissue, *X ray image zooming.

The superior spatial resolution obtained with parallel-beam microradiography over conventional contact microradiography has allowed the authors to image microstructural features of dental hard tissue not previously reported. Their efforts to extend these techniques to provide a real-time capability for viewing in situ demineralization and remineralization effects, at and below the 1 micrometer level, have resulted in an instrument with several novel and unique features. Using a synchrotron radiation source of x rays and diffraction image magnification, they are now able to change magnification at will (x-ray zoom lens). In addition, the energy range over which the instrument operates gives one considerable flexibility in optimizing image contrast. The techniques of parallel-beam microradiography, and diffraction image magnification are applicable to problems in many other areas of science. Using examples within dental research, the uniqueness and versatility of these new techniques are discussed.

801,085

PB88-198064 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Octacalcium Phosphate as a Precursor In Blomlner Formation.

Final rept.,
W. E. Brown, N. Eidelman, and B. Tomazic. 1987, 8p
Grant PHS-HL-30035
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Advances in Dental Research 1, n2 p306-313 Dec 87.

Keywords: *Calcium phosphates, Calcification, Reprints, *Hydroxyapatite, Octacalcium phosphate.

Apatitic biomaterials are formed through a precursor mechanism in which octacalcium phosphate (OCP), $\text{Ca}_8\text{H}_2(\text{PO}_4)_6 \cdot 2\text{H}_2\text{O}$, precipitates first and then hydrolyzes irreversibly in situ to a transition product intermediate to OCP and OHAP; and (ii) that this product, 'octacalcium phosphate hydrolyzate' (OCPH), may contain (a) OHAP-like and OCP-like domains in varying amounts, (b) vacancy defects and impurity ions in lattice sites in these domains, and (c) various kinds of

one-, two-, and three-dimensional defects which are not present in either the OHAP or the OCP lattice, these defects being formed during the in situ hydrolysis step. A calcification model of this type was first proposed in 1957, but full acceptance was delayed because most of the evidence was circumstantial and in vitro in nature. The situation has changed radically because of three unrelated studies that are in vivo in nature but lead to the same conclusion: I. (32)P-pyrololysis studies of rat enamel: The results clearly demonstrated that an acidic calcium phosphate precursor was involved. II. Precipitation of calcium phosphates in serum. Ultrafiltered serum was equilibrated with brushite. Subsequent changes in the ionic concentrations revealed that OCP never reached the solubility of OHAP. III. Physicochemical properties of cardiovascular biomaterials: OCPH was the prototype most compatible with the data. The calcification model has important consequences relative to all kinds of calcification and decalcification processes, including those of enamel.

801,086

PB88-228218 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Non-Normal Distribution of Failure Stresses In a Porcelain-to-Metal Systems Evaluation.

Final rept.,
W. G. de Rijk, J. A. Tesk, and R. W. Penn. 1988, 3p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Proceedings of Southern Biomedical Engineering Conference (6th), Dallas, TX., October 23-24, 1987, p131-133 1988.

Keywords: *Dental prostheses, Distribution, Porcelain, Metal, *Failure stresses.

A method has been developed for the evaluation of the strengths of porcelain-fused-to-metal (PFM) systems as used in dental prostheses. The method uses a composite bending beam to produce uniform tensile stresses in the PFM interface, the metal, and the porcelain. For four different PFM systems it was found that the failures did not conform to a normal distribution but did follow the Weibull distribution. The Weibull parameter and scale parameter have been determined for these systems via Newton Raphson iteration and curve fitting routines. The difference between the Weibull parameters determined for PFM systems are significant from each other and from using the confidence estimates of Thoman et. al., and the normal distribution equivalent.

801,087

PB88-238688 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Pulpal Response to a Dentin and Enamel Bonding System.

Final rept.,
A. A. Chohayeb, R. L. Bowen, and J. Adrian. 1988, 3p
Contract PHS-DE-05129
Sponsored by American Dental Association Health Foundation, Chicago, IL., and Public Health Service, Rockville, MD.
Pub. in Dental Materials 4, p144-146 1988.

Keywords: *Dental materials, *Bonding, *Adhesion, Dentin, Enamel, Reprints, PMDM, NPG-GMA, Pulpal response.

The purpose of the pilot study was to evaluate the pulpal response to compounds that promote strong adhesion to dentin and enamel. Two adult beagle dogs were used. Class V cavities were prepared on the labial surfaces of the teeth using an air turbine handpiece and water coolant. After application in sequence of ferric oxalate, water, air, an acetone solution of NPG-GMA (the addition reaction product of N-phenylglycine and glycidyl methacrylate), acetone, air, an acetone solution of PMDM (the addition reaction product of pyromellitic dianhydride with 2-hydroxyethyl methacrylate), and then air, all experimental cavities were restored with Adaptic. The teeth from one quadrant in each dog received Adaptic without any pretreatment (control). The findings indicated that 28 days postoperatively there were no inflammatory changes in the pulps of the experimental teeth and mild responses in the control teeth. At 3 days, while the control teeth showed some inflammatory response, the experimental teeth did not exhibit significant inflammatory response. Within the parameters of the investigation, the results suggest that the experimental materi-

als did not cause pulpal irritation. Furthermore, it appears that they provided some measure of pulp protection compared to the controls.

801,088

PB88-238852 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Extracellular Potassium Concentrations in Human Dental Plaque Fluid Recovered from Single Sites.

Final rept.,
C. M. Carey, L. C. Chow, A. Tatevossian, and G. L. Vogel. 1988, 6p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Archives of Oral Biology 33, n7 p493-498 1988.

Keywords: *Body fluids, *Chemical analysis, *Potassium, Quantitative analysis, Humans, Reprints, *Dental plaque, *Extracellular fluid, Microelectrodes, Ion-selective electrodes.

Previous studies using potassium ion-selective microelectrodes have demonstrated that potassium concentrations in dental plaque fluid obtained by centrifugation are identical to whole plaque values determined immediately after collection. Such procedures were now used to examine the variations in potassium concentrations between single-site samples of overnight-fasted resting plaque fluid. The potassium concentrations ($67.3 \pm 10.8 \text{ mmol/L}$, $N = 50$) were similar to those found before in whole plaque within 1 min of removal from the mouth and did not appear to be site-dependent. Possible mechanisms for the maintenance of potassium in plaque fluid at higher than salivary levels are described.

801,089

PB88-238860 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Buffer Capacity of Single-Site, Resting, Human Dental-Plaque Fluid.

Final rept.,
C. M. Carey, T. M. Gregory, A. Tatevossian, and G. L. Vogel. 1988, 6p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Archives of Oral Biology 33, n7 p487-492 1988.

Keywords: *Body fluids, Saliva, Buffers(Chemistry), Carbonates, Phosphorus inorganic compounds, Proteins, Amino acids, Organic acids, Reprints, *Dental plaque, *Extracellular fluid, Phosphates.

A carbonate equilibration method was used to measure the buffer capacity of resting plaque fluid collected from single buccal or interproximal sites of upper and lower first molars or anterior teeth. The maximum buffer capacity was 26 m-equiv./l at pH 7.1. The buffer contribution from the measured concentrations of phosphate and carbonate was calculated for each sample. These values were compared with the buffering actually measured and with that expected from organic acids, proteins, and amino acids at average values, as taken from reports in the literature. Relative contributions of buffer species at the average pH of the samples (6.86) were: 35 percent phosphate; 10 percent carbonate; 10 percent protein; 10 percent organic acids; 2 percent amino acids; 30 percent unidentified. There were no significant differences in the buffer capacities of samples originating from sites that differ in their accessibility to saliva. Buffering in resting plaque fluid is more than twice that in saliva and did not show differences correlated with the intra-oral location of the samples.

801,090

PB88-238878 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Determination of Extracellular Fluid Volume In Whole Dental Plaque Using Potassium- or Chloride-Selective Micro-Electrodes.

Final rept.,
C. M. Carey, G. L. Vogel, and L. C. Chow. 1988, 4p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 67, n5 p866-869 May 88.

Keywords: *Body fluids, *Chemical analysis, Volume, Potassium, Chlorides, Humans, Laboratory animals,

Reprints, *Dental plaque, *Extracellular fluid, Microelectrodes, Ion-selective electrodes.

The paper describes a procedure for the determination of the volume of water available for diffusion in whole plaque samples collected from single sites. In the procedure, known micro volumes of H₂O were added to single-site plaque samples with calibrated nanoliter pipettes and the potassium or chloride concentration at each dilution measured with ion-selective micro-electrodes. Volumes determined in simultaneous measurements performed with chloride and potassium micro-electrodes were statistically indistinguishable. From the observed constancy in the initial potassium concentration in rat and human plaque fluid, a simplified macro method is suggested which allows for estimation of the extracellular fluid volume within 20% error in plaque samples.

801,091

PB88-238910 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Wear and Microhardness of a Silver-Sintered Glass-Ionomer Cement.

Final rept.,
J. E. McKinney, J. M. Antonucci, and N. W. Rupp.
1988, 5p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Dental Research 67, n5 p831-835 May 88.

Keywords: *Dental materials, *Composite materials, Microhardness, Durability, Lactic acid, Filled composites, Reprints, *Dental cements, *Silver-sintered glass-ionomer cement.

Knoop Hardness and pin-and-disc-wear measurements were made on a commercial silver-sintered glass-ionomer cement. The objective was to determine whether the incorporation of a bonded-metal-to-glass filler would enhance durability as determined by the above measurements. In most cases, in particular for air-stored specimens, the wear resistance was enhanced markedly over that of the conventional materials evaluated previously. The exception was lactic acid-stored specimens for which little, or no, improvement was observed during early periods of wear. The incorporation of silver appeared to provide lubrication, thus reducing wear. However, catastrophic failure from brittle fracture was still a problem, but its occurrence was less frequent.

801,092

PB89-101729 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Effects of Rinses with an Acidic Calcium Phosphate Solution on Fluoride Uptake, Caries, and in situ Plaque pH in Rats.

Final rept.,
C. T. Schreiber, R. J. Shern, L. C. Chow, and A. Kingman. 1988, 5p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 67, n6 p959-963 Jun 88.

Keywords: *Dental caries, *Fluorides, *Calcium phosphates, Oral diseases, Laboratory animals, Rinsing, Reprints, Disease control, Dental care.

The effects of oral rinses on enamel fluoride uptake, caries, and plaque pH in rats were investigated by use of (1) an acidic calcium phosphate solution (CPS) saturated with dicalcium phosphate dihydrate and (2) a 1 percent fluoride (F) solution. Young rats were randomly assigned to one of four mouth-rinse treatment groups and the animals were provided with a cariogenic challenge throughout the study. The groups treated with F exhibited significantly higher mean levels of enamel-bound F than did the non-F groups. Furthermore, CPS significantly increased uptake of F by enamel when used as an adjunct to the F treatment. A strong negative correlation was observed between enamel F content and caries scores, indicating that as more F was incorporated into the teeth, less caries formation occurred.

Pharmacology & Pharmacological Chemistry

801,093

PB88-230321 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Thermodynamics of the Conversion of Penicillin G to Phenylacetic Acid and 6-Aminopenicillanic Acid.

Final rept.,
Y. B. Tewari, and R. N. Goldberg. 1988, 8p
Pub. in Biophysical Chemistry 29, p245-252 1988.

Keywords: *Thermodynamics, *Hydrolysis, Calorimeters, Chemical equilibrium, Activity coefficients, Enthalpy, Entropy, Conversion, Reprints, *Penicillin G, Penicillin amidase, Liquid chromatography.

The thermodynamics of the enzymatic conversion (penicillin acylase) of aqueous penicillin G to phenylacetic acid and 6-aminopenicillanic acid have been studied using both high-pressure liquid-chromatography and microcalorimetry. The reaction was carried out in aqueous phosphate buffer over the pH range 6.0-7.6, at ionic strengths from 0.10 to 0.40 mol/kg, and at temperatures from 292 to 322 K. The data have been analyzed using a chemical equilibrium model with an extended Debye-Huckel expression for the activity coefficients. For the reference reaction, penicillin G(-)(aq) + H₂O(l) = phenylacetic acid(-)(aq) + 6-aminopenicillanic acid(-)(aq) + H(+)(aq), the following parameters have been obtained: K = (7.35 ± 0.15) × 10¹⁰ to the minus 8th power mol/kg, ΔG⁰ = 40.7 ± 0.5 kJ/mol, ΔH⁰ = 29.7 ± 0.6 kJ/mol, and ΔC_p = -240 ± 50 J/mol/K at 298.15 K and at the thermochemical standard state. The extent of reaction for the overall conversion is highly dependent upon the pH.

Physiology

801,094

PB89-137566 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.

Central Nervous System as a Low and High Level Control System.

Final rept.,
J. S. Albus. 1986, 18p
Pub. in Sensors and Sensory Systems for Advanced Robots, p3-20 1986.

Keywords: *Central nervous systems, Control equipment, Models, Artificial intelligence, Joining, Robots, Computers, Reprints, *Control systems.

The division of the central nervous system into high and low level control systems has long been recognized. How these two systems are interconnected and how they influence each other is one of the great mysteries of modern science. Recent attempts to produce intelligent behavior in robots and computer integrated manufacturing systems have produced insights as to how high level goals can be decomposed into low level actions, and how knowledge about the environment can be acquired, stored, and accessed by task decomposition processes to produce sensory-interactive goal directed behavior. Research on computer brain models has also shown how networks of neuron-like elements can learn patterns and motor skills and generalize from one task to another. The paper proposes a model of how the high level understanding, evaluating, goal selection, planning and reasoning functions commonly associated with the mind are tied into the lower level sensing, filtering, recognizing, task execution, and servo control functions that are commonly associated with the mechanisms of the body.

Radiobiology

801,095

PB88-175328 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Industrial, Agricultural, and Medical Applications of Radiation Metrology: Current Status and Prospects for the 1990's.

Final rept.,
J. H. Hubbell. 1987, 6p
Pub. in Proceedings of Pacific Basin Nuclear Conference (6th), Beijing, China, September 7-11, 1987, p407-412.

Keywords: X rays, Density, Gamma rays, Gauges, Metrology, *Albedo, *Radiation metrology, Thickness.

Photon and particle radiations (gamma rays, X-rays, bremsstrahlung, electrons and other charged particles, neutrons) from radioactive isotopes, X-ray tubes, and accelerators are now widely used in gauging, production control, and other monitoring and metrology devices where avoidance of mechanical contact is desirable. The general principles of radiation gauges, which rely on detection of radiation transmitted by the sample, or on detection of scattered or other secondary radiations produced in the sample, are discussed. Examples of such devices currently used in industrial, agricultural, and medical situations are presented, and some anticipated developments are mentioned.

801,096

PB88-175344 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Predicting Beta-Particle Response of Instruments from Their Response to Monoenergetic Electrons.

Final rept.,
C. G. Soares. 1986, 3p
Pub. in Radiation Protection Dosimetry 14, n2 p113-115 1986.

Keywords: Reprints, *Beta particle dosimetry, *Electron absorbed dose, Electron response function, Electron spectrometry, Monoenergetic electron source.

Accelerator-produced, nearly monoenergetic electron beams are being studied for use in obtaining the response of beta-particle dosimetry instrumentation as a function of electron energy. The electron beams produced have been characterized in terms of spatial distribution, particle spectrum, and absorbed dose to plastic. The energy range covered is 130 keV to 2.4 MeV. These beams are being used to determine the degree to which the broad-spectrum response of beta-particle dosimetry instrumentation can be predicted from response to monoenergetic electrons. Three detection systems were studied: a thin-windowed ionization chamber, a thin thermoluminescence dosimeter, and an electron spectrometer. For each of the systems studied, broad-spectrum response was measured with standardized sources of Pm-147, Tl-204, and Sr-90 + Y-90. The response of these instruments was also measured in the nearly monoenergetic electron beams. From the monoenergetic electron responses, a function was constructed of response versus electron energy.

801,097

PB88-177498 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Radiochromic Dosimetry for Validation and Commissioning of Industrial Radiation Processes.

Final rept.,
W. L. McLaughlin, J. C. Humphreys, D. Hocken, and W. J. Chappas. 1988, 10p
Pub. in Radiation Physics and Chemistry 31, n4-6 p505-514 1988.

Keywords: Film dosimeters, Food irradiation, Gamma rays, Optical waveguides, Process validation, Quality control, Reprints, *Commissioning, *Dose mapping, Dosimetry, Electron beams.

Radiochromic dosimeters in various forms, thin films, coated films and papers, optical waveguides, liquid solutions, and small pellets, serve as useful dosimeters for many radiation processing applications. While they cover wide dose ranges (10(0) - 10(6) Gy) as routine dosimeters, if properly calibrated and controlled, they also may be used accurately and reproducibly for dose mapping, dose setting, and process commissioning procedures, as well as for transfer calibration of other routine dosimeters in photon and electron radiation fields.

801,098

PB88-177522 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

National Bureau of Standards Fresh Water Lake Sediment Environmental-Level Radioactivity Standard Reference Materials.

Final rept.,
K. G. W. Inn. 1987, 22p
Pub. in Jnl. of Radioanalytical and Nuclear Chemistry 115, n1 p91-112 1987.

Keywords: *Actinides, Standards, Environment, Fission products, Radioactivity, Sediment, Reprints, *Activation products, *Natural matrix.

The National Bureau of Standards has, for the past five years, been developing natural-matrix, environmental-level radioactivity Stanford Reference Materials in large quantities to be available to users over a ten year time period. These materials have been found to be useful for the evaluation of radiochemical methods and analysis, as interlaboratory comparison materials, and as quality assurance materials. To date, six Standard Reference Materials have been issued: River Sediment, Human Lung, Human Liver, Rocky Flats Soil-1, Freshwater Lake Sediment, and Peruvian Soil. The concentrations of twenty radionuclides have been certified in these materials.

801,099

PB88-177530 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Dosimetry for Industrial Radiation.
Final rept.,
W. L. McLaughlin. 1987, 4p
See also PB82-211236.
Pub. in Transactions of the American Nuclear Society 55, p160-163 1987.

Keywords: *Polymers, *Dosimetry, *Food irradiation, Reprints, *Electron beams, Gamma radiation, Industrial irradiation.

Ionizing radiation is a valuable tool for many industries, such as radiation sterilizing, curing, processing, testing, and food preserving. The measurement of absorbed doses, dose rates and dose distributions in products is vital, not only to quality control, but also to the research and planning, as well as to the establishment and the day-to-day operation of industrial processes. The range of doses and scope of radiation industries are broad, as indicated in Fig 1, where successful radiation applications are listed according to the typical ranges of the applied absorbed dose needed to meet specifications. The radiation sterilization of medical devices and the curing of polymers and composites are growing industries. The favorable prospects for radiation as an alternative to chemicals in foods may soon lead to other broad commercial advantages, particularly where the economics of trade and quarantines are concerned. It has been reported that, for overall radiation processing applications, more than 130 industrial gamma-ray irradiators are presently used in 42 countries, with a capacity of processing medical devices alone exceeding 6 million cubic meters annually.

801,100

PB88-201579 PC A05/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

NBS (National Bureau of Standards) Measurement Services: Calibration of Beta-Particle Radiation Instrumentation and Sources.

Special pub. (Final),
J. S. Pruitt, C. G. Soares, and M. Ehrlich. Apr 88, 77p
NBS/SP-250/21
Also available from Supt. of Docs. See also NUREG-CR-4266. Library of Congress catalog card no. 88-600514.

Keywords: *Beta sources, *Calibration, Radiation doses, *Instrument calibration, *Radiation protection.

In a project funded jointly by the National Bureau of Standards (NBS) and the Nuclear Regulatory Commission (NRC), NBS has developed a calibration facility for beta-particle instruments and sources used in radiation-protection dosimetry. Central to this facility are beta-particle and nearly monoenergetic electron beams characterized in terms of absorbed-dose rates to water and in terms of pulse-height distributions of beta-particle and electron spectra. The documentation utilizes material previously published or otherwise disseminated by members of the staff of the Ionizing Radiation Division of the Center for Radiation Research

(CRR) of the National Bureau of Standards (NBS). After a description of the facility and the procedures, results are given of (1) studies that led to the determination of absorbed-dose rates to water for the NBS beta-particle and nearly monoenergetic electron beams, (2) studies of the influence of source configuration on beta-particle and nearly monoenergetic electron spectra.

801,101

PB89-101547 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Microdosimetric Event Size Distributions in Small Sites in Water Vapour Irradiated by Protons.

Final rept.,
M. J. Berger. 1988, 13p
Sponsored by Department of Energy, Washington, DC.
Pub. in Phys. Med. Biol. 33, n5 p583-595 1988.

Keywords: *Water vapor, *Proton irradiation, Statistical distributions, Neutrons, Reprints, *Microdosimetry, Energy losses, MeV range 01-10, MeV range 10-100.

The paper describes a calculation of the statistical distribution of energy deposition events in small spherical sites in water (with diameters of 1 micrometer or smaller in unit density material) irradiated by protons. The calculation is based on the use of a semiempirical differential ionization cross section for water vapor given by Wilson and Miller, and takes into account proton energy loss straggling and the transport of energy by secondary electrons. Results are given for irradiations by monoenergetic protons with energies from 1 to 20 MeV, and for irradiations with protons set in motion by interactions of 14 and 20 MeV neutrons with hydrogen.

801,102

PB89-118897 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Formation of 8-Hydroxyguanine Moiety in Deoxyribonucleic Acid on gamma-Irradiation in Aqueous Solution.

Final rept.,
M. Dizdareglu. 1985, 6p
Pub. in Biochemistry 24, n16 p4476-4481 1985.

Keywords: *Radiation chemistry, *Deoxyribonucleic acids, *Gamma irradiation, Hydroxyl radicals, Reprints, *Hydroxyguanine, Purinone/amino-dihydro-hydroxy.

Isolation and characterization of a novel radiation-induced product, i.e., 8-hydroxyguanine residue, in deoxyribonucleic acid (DNA), 2'-deoxyguanosine and 2'-deoxyguanosine-5'-monophosphate gamma-irradiated in aqueous solution is described. For this purpose, gamma-irradiated DNA was first hydrolyzed with a mixture of four enzymes, i.e., DNase I, spleen and snake venom exonucleases, and alkaline phosphatase. The analysis by capillary gas chromatography-mass spectrometry of the resulting mixture after trimethylsilylation revealed the presence of a product, which was assigned to 8-hydroxy-2'-deoxyguanosine based on the typical fragment ions of its trimethylsilyl (TMS) derivative. This product was then isolated using reversed-phase high-performance liquid chromatography. The UV and proton nuclear magnetic resonance spectra taken from the isolated product, and accurate mass determination on its molecular ion confirmed the structure suggested by the mass spectrum of its TMS derivative. The yield of 8-hydroxyguanine was also measured. Its mechanisms of formation is believed to involve the OH radical addition to the C-8 position of guanine followed by oxidation of the radical adduct.

801,103

PB89-119010 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Further Comments on Convection Currents in a Water Calorimeter.

Final rept.,
S. R. Domen. 1988, 3p
Pub. in Physics in Medicine and Biology 33, n9 p1083-1085 1988.

Keywords: *Convection, Calorimeters, Thermistors, Water, Velocity, Estimates, Reprints, *Calorimetry, Radiation doses.

Electrical power was dissipated in a thermistor, causing it to rise to equilibrium temperatures above the stagnant surrounding water. Upward convection was simulated by forcing the water to flow at known rates along the thermistor. The disturbances of the equilibri-

um temperatures were measured. The rates of temperature drop are presented as effects of equivalent 'negative' absorbed dose rates. The results are applied in estimating maximum convective velocities as a result of horizontal irradiation of a water calorimeter operated at room temperature.

801,104

PB89-127179 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Ionizing Radiation-Induced Damage in the Deoxyribonucleic Acid of Cultured Human Cells; Identification of 8,5'-Cyclo-2'-Deoxyguanosine.

Final rept.,
M. Dizdareglu, M. L. Dirksen, H. Jiang, and J. H. Robbins. 1987, 4p
Pub. in Biochemical Jnl. 241, n3 p929-932 1987.

Keywords: *Radiation effects, *Gamma rays, *DNA damage, B lymphocytes, Humans, Cell line, Nucleosides, Ionizing radiation, Reprints, *Cyclodeoxyguanosine, Deoxyribonucleosides, Guanosine/cyclo-deoxy.

The identification of the radiation-induced lesion 8,5'-cyclo-2'-deoxyguanosine (8,5'-cyclo-dGuo) in DNA isolated from gamma-irradiated human cells is reported. Epstein-Barr virus-transformed peripheral blood B-lymphocytes were irradiated at 0 deg C at doses from 10 to 100 Gray. The cells were immediately lysed and the DNA was isolated. Subsequently, the DNA was hydrolyzed to 2'-deoxyribonucleosides. The hydrolysate was dried, trimethylsilylated, and analyzed by capillary gas chromatography-mass spectrometry with selected-ion monitoring. Chromatographic retention times and mass spectra were determined for trimethylsilylated samples of authentic (5'R)- and (5'S)-8,5'-cyclo-dGuo. DNA samples from irradiated cells showed the characteristic ions of these compounds with corresponding relative intensities at proper retention times. The (5'R)- and (5'S)-diastereomers of 8,5'-cyclo-dGuo were observed in a ratio of 1 to 3, and their formation was dose-dependent. It was possible to detect and characterize one such single lesion in approximately 40,000 guanine nucleotide subunits of DNA.

Toxicology

801,105

PB88-177340 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Review of the Literature on the Gaseous Products and Toxicity Generated from the Pyrolysis and Combustion of Rigid Polyurethane Foams.

Final rept.,
M. Paabo, and B. C. Levin. 1987, 29p
See also PB86-151941. Sponsored by Consumer Product Safety Commission, Washington, DC.
Pub. in Fire and Materials 11, p1-29 1987.

Keywords: *Carbon monoxide, *Combustion products, *Toxicity, Fire retardants, Hydrogen cyanide, Literature reviews, Polyurethane foams, Rigid foams, Thermal decomposition.

The literature on rigid polyurethane foam has been reviewed with an emphasis on the gaseous products generated under various thermal decomposition conditions and the toxicity of those products. The review is limited to publications in English through 1984. Carbon monoxide (CO) and hydrogen cyanide (HCN) were the predominant toxicants found among more than a hundred other gaseous products. The generation of CO and HCN was found to increase with increasing combustion temperatures. Many test methods were used to assess the acute inhalation toxicity of combustion products from various rigid polyurethane foams. Lethality, incapacitation, physiological and biochemical parameters were employed as biological end points. In general, the combustion products generated from rigid polyurethane foam in the flaming mode appear to be more toxic than those produced in the non-flaming mode. The LC(50) values for 30-min exposures ranged from 10 to 17 mg l(-1) in the flaming mode and were greater than 34 mg l(-1) in the non-flaming mode. With the exception of one case, in which a reactive type phosphorus containing fire retardant was used, the addition of fire retardants to rigid polyurethane foams does not appear to generate unusual toxic combustion products.

801,106
PB88-177357 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Summary of the NBS (National Bureau of Standards) Literature Reviews on the Chemical Nature and Toxicity of the Pyrolysis and Combustion Products from Seven Plastics: Acrylonitrile-Butadiene-Styrenes (ABS), Nylons, Polyesters, Polyethylenes, Polystyrenes, Poly(Vinyl Chlorides) and Rigid Polyurethane Foams.

Final rept.,
B. C. Levin. 1987, 15p
See also PB86-230679. Sponsored by Consumer Product Safety Commission, Washington, DC.
Pub. in Fire and Materials 11, p143-157 1987.

Keywords: *Toxicity, Nylon, Polyester, Polyethylene, Polystyrene, Reprints, *Plastics, Chemistry, *Combustion products, Literature reviews.

A series of literature reviews was undertaken by the National Bureau of Standards to examine the toxicity and chemistry of the effluents produced when seven plastics were decomposed under various thermal and atmospheric conditions. These plastics are: acrylonitrile-butadiene-styrenes, nylons, polyesters, polyethylenes, polystyrenes, poly(vinyl chlorides) and rigid polyurethane foams. The English-language literature on each of these was reviewed and published as a separate report of the National Bureau of Standards. Over 400 different thermal decomposition products, many common to more than one plastic, were identified. The toxicity of most of these individual products is unknown and an assessment of the toxicity of the multitude of possible combinations is not feasible at this time. Therefore a variety of bioassay toxicity protocols have been used to assess the toxicity of the gaseous atmospheres generated by the thermal decomposition of these plastics. In general, these seven plastics did not produce unusually or extremely toxic pyrolysis or combustion products when compared with those of other synthetic or natural materials. In a few cases involving additives, toxic products of concern were produced.

801,107
PB88-177365 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Literature Review of the Chemical Nature and Toxicity of the Decomposition Products of Polyethylenes.

Final rept.,
M. Paabo, and B. C. Levin. 1987, 16p
See also PB86-163409. Sponsored by Consumer Product Safety Commission, Washington, DC.
Pub. in Fire and Materials 11, p55-70 1987.

Keywords: *Combustion products, *Toxicity, Reprints, Literature reviews, *Polyethylenes, Thermal decomposition.

The literature on polyethylenes has been reviewed with an emphasis on the identification of gaseous products generated under various thermal decomposition conditions and the toxicity of those products. The review is limited to publications in English through 1984. The analytical chemical studies of the thermal decomposition products generated under vacuum, inert and oxidative experimental conditions are described. In oxidative atmospheres, which most closely simulate real fire conditions, carbon monoxide (CO) was found to be the predominant toxicant. Acrolein was another toxicant often noted in these reviewed studies. More acrolein was generated under non-flaming than under flaming conditions. Results from seven different test procedures were considered in assessing the acute inhalation toxicity of combustion products from various polyethylene formulations. The combustion products generated from the polyethylenes studied in the non-flaming mode appeared to be slightly more toxic than those produced in the flaming mode. In the non-flaming mode the LC(50) values ranged from 5 to 75 mg l(-1). In the flaming mode the LC(50) values ranged from 31 to 51 mg l(-1). The toxicity of the degradation products of polyethylenes appears to be similar to that found for other common materials designed for the same end uses.

801,108
PB88-177381 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Toxicity of the Pyrolysis and Combustion Products of Poly(Vinyl Chlorides): A Literature Assessment.

Final rept.,
C. Huggett, and B. C. Levin. 1987, 12p
See also PB86-201621.
Pub. in Fire and Materials 11, p131-142 1987.

Keywords: *Combustion products, *Toxicity, Hydrochloric acid, Carbon monoxide, Large scale fire tests, Polyvinyl chloride, Pyrolysis products, Fire tests.

Poly(vinyl chlorides) (PVC) constitute a major class of synthetic plastics. Many surveys of the voluminous literature have been performed. The report reviews the literature published in English from 1969 through 1984 and endeavors to be more interpretive than comprehensive. PVC compounds, in general, are among the more fire resistant common organic polymers, natural or synthetic. The major products of thermal decomposition include hydrogen chloride, benzene and unsaturated hydrocarbons. In the presence of oxygen, carbon monoxide, carbon dioxide and water are included among the common combustion products. The main toxic products from PVC fires are hydrogen chloride (a sensory and pulmonary irritant) and carbon monoxide (an asphyxiant). The LC(50) values calculated for a series of natural and synthetic materials thermally decomposed according to the NBS toxicity test method ranged from 0.045 to 57 mg l(-1) in the flaming mode and from 0.045 to greater than 40 mg l(-1) in the non-flaming mode. The LC(50) results for a PVC resin decomposed under the same conditions were 17 mg l(-1) in the flaming mode and 20 mg l(-1) in the non-flaming mode. These results indicate that PVC decomposition products are not extremely toxic when compared with those from other common building materials. When the combustion toxicity (based on their HCl content) of PVC materials is compared with pure HCl experiments, it appears that much of the post-exposure toxicity can be explained by the HCl that is generated.

801,109
PB89-128946 PC A08/MF A01

Pittsburgh Univ., PA.

New Models to Assess Behavioral and Physiological Performance of Animals during Inhalation Exposures.

Special rept.,
D. E. Malek, and Y. Alarie. Oct 88, 164p NIST/GCR-88/551
Grant NANO-4001
Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Carbon monoxide, *Animals, Exposure, Toxicity, Fires, Smoke, Respiration, Behavior, Evaluation, Ergometers.

Previously the toxicity of fire smoke has been examined primarily in sedentary animals and lethality was noted. The evaluation of escape potential from a toxic environment, however, requires the measurement of sublethal responses in active animals that are escape predictive. To address this need the mouse track model and the guinea pig ergometer model have been developed. The mouse track model was a ventilated 'S' shaped exposure system. Performance was evaluated by two sublethal responses, distance traveled/time and incapacitation. A novel feature of the mouse track model was its ability to detect an early deterioration in performance before incapacitation and death. The guinea pig ergometer model was designed where a 4.9L exposure chamber enclosed a motor driven rubberized wheel. Extrapolation of exercising guinea pig data to human was similar to theoretical models that predict human response to CO. Humans were estimated to progress five times the distance of the guinea pig at a similar level of toxicity for CO.

Zoology

801,110
PB88-199732 PC A04/MF A01

National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.

Alaskan Marine Mammal Tissue Archival Project: A Project Description Including Collection Protocols.

P. R. Becker, S. A. Wise, B. J. Koster, and R. Zeisler. Mar 88, 54p NBSIR-88/3750
Prepared in cooperation with National Ocean Service, Anchorage, AK. Ocean Assessments Div.

Keywords: *Mammals, *Aquatic animals, *Tissues(Biology), Alaska, Tissue culture, Contaminants, Marine biology, Archives, Seals(Mammals), Polar region, Petroleum industry, Trace elements, Collection, Pollution, Organic compounds, Pollutants, Ecosystems, Aquatic ecosystems.

The Alaskan Marine Mammal Tissue Archival Project was initiated in 1987. Although the emphasis is on the collection of tissues for analysis of contaminants that may be associated with the petroleum industry, the development of an archive of marine mammal tissues collected and stored using carefully controlled procedures provides an important resource addressing questions concerning the transport of elements and compounds (contaminants and non-contaminants) throughout the polar ecosystem. The document provides the basic information on Project objectives and management, justification for the species, tissues, and contaminants of interest, and specific instructions for collecting, handling, and storing samples.

MILITARY SCIENCES

Logistics, Military Facilities, & Supplies

801,111
PB89-126619 PC A09/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

Analysis of Work Environment Data from Three Army Field Stations.
B. L. Collins, and A. I. Rubin. Oct 88, 177p NISTIR-88/3871

Keywords: *Environmental surveys, *Military facilities, Workplace layout, Noise, Lighting, Temperature, *Indoor air pollution, US Army, *Air quality.

Data from a detailed evaluation of environment conditions in three U.S. Army field stations are presented. Three field stations were evaluated: Kunia, Augsburg, and Berlin. Results from a questionnaire administered to over 600 people at all sites in three job types (operator, analyst, and administrative/other) are given which indicate major concerns with conditions such as temperature, lighting, space, furniture, equipment functioning, and general environmental quality. Physical data obtained from measurements of over 270 workstations indicated the presence of cold temperatures, low light levels, reduced VDT screen contrast, glare, and distracting noises. The report provides the basic data which support the concerns expressed by Headquarters; namely, that field station personnel perform their jobs under conditions likely to impair their effectiveness. Suggestions for improving conditions are given in a companion report by Rubin and Collins.

Military Operations, Strategy, & Tactics

801,112
PB89-129506 PC A07/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.

System Description and Design Architecture for Multiple Autonomous Undersea Vehicles.

Technical note (Final).
J. S. Albus. Sep 88, 128p NIST/TN-1251
Also available from Supt. of Docs. Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

MILITARY SCIENCES

Military Operations, Strategy, & Tactics

Keywords: *War games, *Control equipment, *Artificial intelligence, *Game theory, Simulation, Strategy, Mathematical models, Dynamic programming, Submarines, *Architecture(Computers), *Multiple Autonomous Undersea Vehicles Project.

The objective of the MAUV project is to demonstrate intelligent cooperative behavior in multiple autonomous undersea vehicles. The approach is to build a control system architecture which will fully integrate concepts of artificial intelligence and game theory with those of modern control theory. The control system is being designed to permit a team of cooperating intelligent vehicles to compete against a team of cooperating intelligent opponents in a real-time dynamic environment. Among the significant technologies being pursued are: Real-time planning, using game theory and value driven logic; Dynamic world modeling, using multi-dimensional world maps and a real-time object oriented database; Sensory data fusion, using egosphere representations, real-time model matching, and stereo/motion integration; Multiplayer gaming.

General

801,113

PB88-177316

Not available NTIS

National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Temperature Variation of the Elastic Constants of Aluminum Alloy 2090-T81.

Final rept.,

J. Glazer, J. W. Morris, S. A. Kim, M. W. Austin, and H. M. Ledbetter. 1987, 2p

Sponsored by Department of Energy, Washington, DC. Pub. in AIAA (American Institute of Aeronautics and Astronautics) Jnl. 25, n9 p1271-1272 Sep 87.

Keywords: *Aluminum lithium alloys, Low temperatures, Reprints, *Elastic constants, Poisson ratio, Ultrasonics.

Using ultrasonic methods, between 295 and 4 K, the authors studied the elastic properties of an Al-Li-Cu alloy. Despite the alloy's remarkable ambient-temperature properties, the temperature dependence corresponds closely to pure aluminum's. The authors give results for both Young modulus and Poisson ratio.

801,114

PB88-230479

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering. **Credible Measurements: A Prerequisite for Defense Readiness.**

Final rept.,

B. C. Belanger, and H. Hellwig. 1988, 5p

Pub. in National Defense, p26-30 Feb 88.

Keywords: *Metrology, National defense, Reprints, National Bureau of Standards, US NBS.

The paper summarizes the kinds of metrology requirements generated by modern defense technology, and the NBS role in meeting those requirements.

Keywords: *Mica, *Cracks, Environments, Nitrogen, Air, Water, Hysteresis, Reprints.

Kinetic crack effects in mica in nitrogen, air and water environments are investigated. There are applied loading thresholds below which the cracks close up and heal. Significant hysteresis is observed during load-unload-reload cycles. The results are interpreted in terms of the restraining influence of oscillatory attractive surface forces at the crack interface.

801,116

PB88-230404

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Order-Disorder in Omphacitic Pyroxenes: A Model for Coupled Substitution in the Point Approximation.

Final rept.,

P. M. Davidson, and B. P. Burton. 1987, 8p

Pub. in American Mineralogist 72, p337-344 1987.

Keywords: *Silicate minerals, Order disorder transformations, Approximation, Substitutes, Reprints, *Pyroxenes.

The authors develop a generalized point approximation for binary solutions that have coupled mixing on nonequivalent sites that may themselves be involved in coupled ordering transitions. For omphacite pyroxene solutions, ordering within the M1 sites is linked to ordering within M2 sites, so that disordering occurs at a single T(c) (critical temperature). In the authors model, coupled ordering in omphacites is achieved through both geometric and energetic parameters that account for the difference in cation-cation coordination number and the cross-site cation-pair-exchange energy (Delta G sup 0). Although the model necessarily neglects short-range order, calculated phase-diagram topologies agree qualitatively with experiments and TEM observations. Differing degrees of long-range order are predicted at temperatures below T(c) for unequal intrasite ordering energies. Asymmetric or compositionally dependent functions for (Delta G sup 0) complicate phase-diagram topologies and increase the possibility for stable coexistence of two ordered phases.

801,117

PB89-114714

PC A03/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.

Plan for a Design Study for a National Earthquake Engineering Experimental Facility,

C. F. Scribner, and E. V. Leyendecker. Oct 86, 25p

NBSIR-86/3453

Contract EMW-85-E-2134

Sponsored by Federal Emergency Management Agency, Washington, DC.

Keywords: *Earthquakes, *Engineering, *Design, Earthquake resistant structures, Earth movements, Rock mechanics, Static loads, Stress, Standards, Building codes, US NRC.

The report describes the work plan for a four-phase study to determine the needs for and design details of a national earthquake engineering research facility. The need for data on the behavior of full-scale buildings and building components was recognized by the National Research Council in the report 'Earthquake Engineering Facilities and Instrumentation', which was produced by the NRC ad hoc Committee on Earthquake Engineering Facilities and Instrumentation in 1984. The report discusses in detail the study NBS will conduct in cooperation with the Federal Emergency Management Agency, the National Science Foundation, the United States Geological Survey, and other agencies.

Mineral Industries

801,118

PB88-222872

PC A04/MF A01

Louisiana State Univ., Baton Rouge. Dept. of Petroleum Engineering.

Experimental Study of Suppression of Obstructed Gas Well Blowout Fires Using Water Sprays.

Final rept.,

M. R. Chauvin, and A. T. Bourgoyne. Jun 88, 54p

NBS/GCR-88/547

Grant NANB-5-D0533

Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Blowouts, *Fire tests, Offshore drilling, Extinguishing, Water, *Natural gas wells.

The effect of obstructions in the gas flow on the ability of water sprays to extinguish simulated gas well blowout fires was examined using test fires with natural gas flow rates up to 35 MMSCF/D. The series of tests extends previous measurements of water spray extinguishment of simulated un-obstructed natural gas blowout fires adding obstructions that would almost certainly be present during accidents on actual platforms. It was found that the presence of obstructions in the gas flow increased the amount of water needed to extinguish the fire compared to an un-obstructed blowout fire. It is believed that an obstruction increases air/gas mixing while at the same time it decreases water/gas mixing.

Soil Sciences

801,119

PB88-203757

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Procedures Used to Predict the Thermal Behavior of Soils.

Final rept.,

L. A. Salomone. 1987, 5p

Pub. in Proceedings of International Conference on Energy Efficient Buildings with Earth Shelter Protection, Sidney, Australia, p49-53 Aug 83.

Keywords: *Structures, *Thermal conductivity, *Soil properties, Mathematical models, Thermal resistivity, Soil water, Moisture content, Plasticity, Soil tests, Cost effectiveness, Evaluation, Stresses, Reprints.

The thermal conductivity of soils can vary in time and space because of changes in moisture content, density and/or soil type. Nevertheless, a majority of existing computer models of the energy exchange between earth-contact structures and the surrounding soil do not account for the variation in soil thermal conductivity. Constant values of soil thermal properties are often used in these computer models. To achieve better agreement between measured temperature fields and heat fluxes and those predicted by computer models, incorporation of the variation in soil thermal conductivity into the computer models will be necessary. The paper discusses the factors that were found to affect significantly the thermal resistivity (the reciprocal of thermal conductivity) of soils and presents an approach for establishing the values of soil thermal resistivity to be used when evaluating the energy exchange between earth-contact structures and the surrounding soil.

General

801,120

PB88-176813

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Recent Improvements in Radiometric Accuracy Based on New Detector Technology.

Final rept.,

J. Geist. 1987, 3p

Pub. in Remote Sensing of Environment 22, p127-129 1987.

Keywords: *Radiometry, *Standards, Remote sensing, Detectors, Accuracy, Reprints, Sensors.

Until recently, the best accuracy achievable in the measurement of radiometric properties was limited by the accuracy of the ultimate radiometric standard to which the measurement could be traced. Since about 1980, however, there have been such dramatic im-

NATURAL RESOURCES & EARTH SCIENCES

Geology & Geophysics

801,115

PB88-175625

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Crack Velocity Thresholds and Healing Mica.

Final rept.,

D. H. Roach, D. M. Heuckeroth, and B. R. Lawn.

1986, 3p

Sponsored by Office of Naval Research, Arlington, VA. Pub. in Jnl. of Colloid and Interface Science 114, n1 p292-294 Nov 86.

provements in the accuracy of detector-based standards that this is no longer the case. These new radiometric standards are briefly reviewed in the paper, with emphasis on the intercomparisons that demonstrate their accuracy.

801,121
PB89-101497 Not available NTIS
National Bureau of Standards (NBS), Boulder, CO.
Electromagnetic Fields Div.

Electromagnetic Scattering by Buried Objects of Low Contrast.

Final rept.,
D. A. Hill. 1988, 9p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Geoscience and Remote Sensing 26, n2 p195-203 Mar 88.

Keywords: *Electromagnetic scattering, *Subsurface structures, Rayleigh scattering, Far field, Plane waves, Remote sensing, S matrix theory, Reprints, *Underground structures, Born approximation, Near field.

The Born approximation is used to derive the plane-wave scattering matrix for objects of low dielectric contrast. For general shapes a numerical integration over the volume of the scatterer is required, but analytical expressions are derived for a sphere, a circular cylinder, and a rectangular box (parallelepiped). The plane-wave scattering-matrix theory is used to account for the air-earth interface. Numerical results are presented for the scattered near field and far field for plane-wave excitation. The scattered fields are weak for low-contrast objects, but the near-field results have application to electromagnetic detection of buried objects.

NUCLEAR SCIENCE & TECHNOLOGY

Fusion Devices (Thermonuclear)

801,122
PB88-227814 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

Nuclear Resonance Effects on the Muon Sticking Probability in Muon Catalyzed D-T Fusion.

Final rept.,
M. Danos, B. Muller, and J. Rafelski. 1988, 10p
Sponsored by Department of Energy, Washington, DC.
Pub. in Muon Catalyzed Fusion 3, p443-452 1988.

Keywords: Reprints, *Muon-catalyzed fusion, Muon reactions, Nuclear resonance.

It is shown that the calculation of the muon sticking probability requires the incorporation of the interplay of the nuclear reaction dynamics with the three-body Coulomb problem.

801,123
PB89-100556 PC A17/MF A01
National Bureau of Standards (IMSE), Boulder, CO.
Fracture and Deformation Div.

Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures-XI.

Technical rept.,
R. P. Reed. May 88, 389p NBSIR-88/3082
See also PB87-232575. Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.

Keywords: *Superconducting magnets, Austenitic steels, Cryogenics, Mechanical properties, Stainless steels, Structural steels, Alloy steels, Aluminum alloys, Composite materials, Welded joints, *Thermonuclear reactor materials.

The report contains the results of a research program to determine the properties of materials that may be used in cryogenic structures for the superconducting magnets of magnetic fusion energy power plants and prototypes. Its purpose is to facilitate their design and development. The program was developed jointly by the staffs of the National Bureau of Standards and the Office of Fusion Energy of the Department of Energy; it is managed by NBS and sponsored by DOE. Research

is conducted at NBS and at other laboratories through subcontracts with NBS. Research results for 1987 are presented in technical papers under five headings that reflect the main program areas: Structural alloys, Welding, Nonmetallics, Technology Transfer, and United States-Japan Development of Test Standards. Objectives and research highlights are summarized in the introduction to each program area.

801,124
PB89-123343 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO.
Fracture and Deformation Div.

Strain-Controlled Torsional Test Method for Screening the Performance of Composite Materials at Cryogenic Temperatures.

Final rept.,
M. B. Kasen. 1988, 5p
Sponsored by Department of Energy, Washington, DC.
Office of Magnetic Fusion Energy.
Pub. in Jnl. of Materials Science 23, p830-834 1988.

Keywords: *Strains, *Cryogenics, *Composite materials, Tests, Experimental design, Organic compounds, Samples, Failure(Materials), Creep rupture strength, Neutron irradiation, Insulated conductors, Nuclear fusion, Magnetic induction, Torsion, Nuclear reactors, Polymers, Metals, Reprints.

A system has been developed for rapid measurement of the torsional properties of organic-matrix composite materials at temperatures from 4 to 295 K. It offers ease of construction, simplicity of specimen design, small specimen size, rapid specimen turnaround, and low consumption of cryogenics. In addition to providing quantitative data on the modulus of rupture and of rigidity, the strain-control feature facilitates analysis of the stress-displacement curve in the region where damage is occurring, providing useful information on the influence of various parameters on the failure mode. The system was optimized for rapid screening of the influence of component variables on the performance of electrical insulators required to function in the cryogenic irradiation environment of superconducting magnets in magnetic fusion energy systems. However, it is also useful in studying the influence of cryogenic environment on unreinforced polymers and on metals and alloys.

Isotopes

801,125
PB88-175302 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

New Applications of Resonance Neutron Radiography.

Final rept.,
R. A. Schrack. 1986, 6p
Pub. in Radiation Effects 95, n1-4 p303-308 1986.

Keywords: *Isotopes, *Neutrons, Reprints, *Resonance neutron radiography.

The determination of the location and amount of an isotope in a complex matrix of materials, termed Resonance Neutron Radiography, has been applied to a variety of nondestructive assay tasks in the fields of nuclear power, ordinance, industry, and agriculture.

801,126
PB88-175492 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.

Ultra-Sensitive Laser Isotope Analysis in an Ion Storage Ring.

Final rept.,
J. J. Snyder, T. B. Lucatorto, P. H. Debenham, and S. Geltman. 1985, 6p
Contract DE-A101-85ER60302
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of the Optical Society of America B 2, n9 p1497-1502 Sep 85.

Keywords: *Isotope separation, Analyzing, Ionization, Reprints, Laser isotope separation.

The authors propose a novel method for ultra-sensitive isotope analysis that combines magnetic mass selection, resonant charge exchange neutralization, and resonant laser ionization. Their method attains very

high isotopic abundance selectivity by means of continuous multi-stage separation of ions stored in a small ring. For the environmentally interesting case of (90)Sr vs. (88)Sr, they estimate that sensitivity better than 10 to the -15th power for a throughput of 10 to the 13th power atoms/s, and an efficiency (after the ion source) greater than 10% are readily achievable.

Nuclear Instrumentation

801,127
PB88-168620 PC A03/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

NBS (National Bureau of Standards) Measurement Services: Alpha-Particle Calibrations.

Special pub. (Final),
J. M. R. Hutchinson. Jul 87, 38p NBS/SP-250/5
Also available from Supt. of Docs. as SN003-003-02823-1. Library of Congress catalog card no. 87-619849.

Keywords: *Alpha particle detectors, Alpha particles, Proportional counters, Scintillation counters, Radioactivity, Standards, *Calibration.

The document describes the alpha-particle calibration services offered by the Radioactivity Group of the National Bureau of Standards (NBS) (Scheduled Calibrations: 43030C and 43040C; formerly 8.2H and 8.2I). The fundamental measurement quantities are defined, the measurement approach is described (or reviewed), and the operating procedures are described from the point of view of the calibration technician or metrologist. The measurement uncertainties, and how they are estimated, are described. Methods for maintaining and assessing quality control, e.g., international comparisons, MQA programs, etc. are also briefly reviewed.

801,128
PB88-180666 PC A04/MF A01
National Bureau of Standards, Gaithersburg, MD.

Directory of Calibration Services for Ionizing Radiation Survey Instruments.

Final rept.,
H. T. Heaton. Jan 88, 55p NBS/GCR-88/539
Contract NB80-NANA-1046
Sponsored by Conference of Radiation Control Program Directors, Inc.

Keywords: *Radiation measuring instruments, *Directories, *Ionizing radiation, *Calibrating, Services.

The directory provides information about calibration services for ionizing radiation survey instruments. Its basic purpose is to tell the owner or user of a survey instrument where a calibration might be obtained. After introductory definitions of critical terms and a general description of quality assurance programs, available calibration services are listed. First, a summary of services is provided in which companies are listed alphabetically by company name and also alphabetically by state. Then a detailed list of services is provided for each type of radiation used to perform a calibration: alpha particles, beta particles, gamma rays, neutrons, and x rays. The final list shows the name, address, phone number, and person to contact for each company included in the directory.

801,129
PB88-193750 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Liquid Optical Waveguide Dosimetry in Continuous and Pulsed Radiation Fields.

Final rept.,
B. B. Radak, B. L. Secerov, W. L. McLaughlin, and M. G. Simic. 1987, 7p
Pub. in Proceedings of Symposium on Radiation Chemistry (6th), Tihany, Hungary, August 16-22, 1987, p711-717.

Keywords: *Dosimetry, Electron beams, Fiber optics, Radiolysis, Gamma dosimetry, Radiation doses, Optical waveguides.

A radiochromic solution, namely, 5 mmol/l solution of hexahydroxyethyl paracosaniline cyanide and 17 mmol/l acetic acid in N,N-dimethylformamide, was used as the liquid core of a 50 cm long liquid optical

NUCLEAR SCIENCE & TECHNOLOGY

Nuclear Instrumentation

waveguide (OWG). It was this dosimetric assembly whose absorbance both during and after the irradiation has been measured by a simple design similar to one recently described, containing the same radiochromic dye in dimethyl sulfoxide (LED light source : OWG dosimeter : neutral OWG : shielded photodiode). The behavior of this system in both a continuous gamma-ray field (^{60}Co) and a pulsed beam (x-ray converter with a Febetron 707 electron accelerator) has now been investigated. The sensitivity (absorbed dose readings of 0.1 Gy plus or minus 4 percent) is discussed, as well as the new experimental approach for improvement of the optical absorbance measurements in continuous and pulsed radiation fields.

801,130

PB89-119184

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Radiochromic Dye Dosimeter Solutions as Reference Measurement Systems.

Final rept.,

M. Farahani, and W. L. McLaughlin. 1988, 8p

Pub. in Radiation Physics and Chemistry 32, n5 p683-690 Sep 88.

Keywords: *Dosimeters, *Dyes, Radiation effects, Cyanides, Polymers, Visible spectrum, Dosimetry, Reprints, Radiochromic dyes.

Solutions of leucocyanides of triphenylmethane dyes in organic solvents are designed as stable reference dosimeters for large radiation doses, with useful characteristics, both for steady-state and pulsed radiation fields. These radiochromic solutions may be used in conventional glass ampules to cover the absorbed dose range 100-10,000 kGy, when analyzed spectrophotometrically at visible wavelengths at the maxima of radiation-induced absorption bands. The radiation chemical yields of dye formation (G-values) and molar linear absorption coefficients of the dyes in several formulations, with and without dissolved polymer and weak oxidizing agents, are established. The most stable formulation before and after irradiation consists of new fuchsin cyanide in a mixture of dimethyl sulfoxide and triethyl phosphate containing small amounts of acetic acid, p-nitrobenzoic acid and polyvinyl butyral. The useful range of doses for this solution is 100-4,000 Gy when measured at 557 nm wavelength. The radiation chemical yield, G-value for dye production, is 3.35×10 sup 15 molec J sup -1 (0.0055 micromol J sup -1) and the value of the molar linear absorption coefficient at this wavelength is 1.32×10 sup 5 M sub -1 cm sub -1.

Radiation Shielding, Protection, & Safety

801,131

PB89-101554

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Conversion of Depth-Dose Distributions from Slab to Spherical Geometries for Space-Shielding Applications.

Final rept.,

S. M. Seltzer. 1986, 6p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-33, n6 p1292-1297 Dec 86.

Keywords: *Radiation shielding, Bremsstrahlung, Electrons, Slabs, Reprints, *Depth dose distributions, *Radiation dose distributions, Spherical configuration.

An approximate procedure has been developed to transform depth-dose distributions in simple slab targets so as to obtain the spatial distribution of dose in spherical target configurations for space-shielding applications. Emphasis is placed on the determination of electron and bremsstrahlung dose, which would otherwise require more costly three-dimensional Monte Carlo calculations. For the electron-bremsstrahlung problems tested, results from the procedure require only a fraction of the computer time and are found to agree to within 10-20 percent as compared to direct, three-dimensional Monte Carlo calculations.

Reactor Engineering & Nuclear Power Plants

801,132

PB88-215140

PC A03/MF A01

National Bureau of Standards (IMSE), Gaithersburg, MD.

Review of Candidate Methods for Detecting Incipient Defects Due to Aging of Installed Cables in Nuclear Power Plants.

F. I. Mopsik, E. F. Kelley, and F. D. Martzloff. May 88, 15p NBSIR-88/3774

See also NUREG/CR-4740. Sponsored by Nuclear Regulatory Commission, Rockville, MD.

Keywords: *Nuclear power plants, *Electric cables, Age, Degradation, Test methods, Defects, Electrical insulation, Spectroscopy, Electric discharges.

Several types of test methods have been proposed for detecting incipient defects due to aging in cable insulation systems, none offering certainty of detecting all possible types of defects. Some methods apply direct detection of a defect in the cable; other methods detect changes in electrical or non-electrical parameters from which inferences can be drawn on the integrity of the cable. The paper summarizes the first year of a program conducted at the National Bureau of Standards to assess the potential of success for in situ detection of incipient defects by the most promising of these methods.

OCEAN TECHNOLOGY & ENGINEERING

Biological Oceanography

801,133

PB89-101687

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Role of Biogenic Thiols in the Solubility of Sulfide Minerals.

Final rept.,

D. Shea, and W. MacCrehan. 1988, 7p

Pub. in Science of the Total Environment 73, p135-141 1988.

Keywords: *Thiols, *Chemical analysis, Chromatographic analysis, Sulfur inorganic compounds, Sulfur organic compounds, Electrochemistry, Sediments, Trace elements, Reprints, *Marine environments.

Efforts to account for observed trace metal concentrations in anoxic marine waters have had only limited success due in part to the lack of knowledge of the identity and concentration of the organic sulfur compounds that are present. There have been no previous attempts to measure trace metals concentrations simultaneously with the inorganic and organic sulfur species in marine waters. In addition to the conventional methods for the determination of the inorganic species, methods are being developed for the determination of the biogenic thiols and disulfides using an HPLC separation coupled to selective electrochemical detection. Preliminary results on the analysis from anoxic sediment pore waters are presented. Current thermodynamic models describing the solubility of sulfide minerals in anoxic marine waters are refined to include complexation of chalcophile trace metals by organic thiols.

General

801,134

PB88-234208

PC A05/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Lighting Group.

Lights of New York Harbor,

J. A. Worthy. Jun 88, 92p NBSIR-88/3807

Sponsored by Coast Guard Research and Development Center, Groton, CT.

Keywords: *Navigational lights, Luminous intensity, Visibility, Measurement, Photometer, Spherical trigonometry, *New York Harbor.

The report presents measurements of shore lights of the New York harbor area, taken from three observation points. In particular, measurements were made of the illuminance at the observation point due to distant lights, considered to be point sources. This is a measure of point source intensity appropriate to the situation, and quantifies what a mariner will see sailing into or out of New York harbor at night. The measurements are of interest because lights on shore make it hard to see the lights maintained by the U.S. Coast Guard as aids to navigation. One conclusion is the most of the interfering lights are high-pressure sodium vapor lamps used to light the streets, roads, and docks. The distributions of the lights in intensity, position, and color are presented graphically.

PHOTOGRAPHY & RECORDING DEVICES

Photographic Techniques & Equipment

801,135

PB88-193883

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Development of an Intensified Digital Line Camera System for Real-Time Line Measurements in Turbulent Flows.

Final rept.,

W. M. Pitts. 1985, 4p

Pub. in Chemical and Physical Processes in Combustion, p82.1-82.4 1985.

Keywords: *Concentration(Composition), *Turbulent flow, *Cameras, Real time operations, Rayleigh scattering, Propane, Reprints.

The development of a real-time, intensified, digital line camera system is described. The effectiveness of the camera is demonstrated by recording the real-time concentration fluctuations which occur within a turbulent flow of propane into a slow coflow of air. Rayleigh light scattering is used as the concentration probe.

Recording Devices

801,136

PB88-169537

PC A09/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.

Evaluation of a Copy Prevention Method for Digital Audio Tape Systems.

B. A. Bell, G. N. Stenbakken, D. R. Flynn, D. J. Evans, and E. D. Burnett. Feb 88, 189p NBSIR-88/3725

Color illustrations reproduced in black and white.

Keywords: *Digital recording, *Tape recording, *Reproduction(Copying), Protection, Music, Performance evaluation, Audio recording.

The National Bureau of Standards in response to requests from the U.S. Congress tested a system designed to prevent unauthorized copying by digital audio tape (DAT) recorders of suitably encoded audio recordings. The system, designed by CBS Records, filters out a narrow range of frequencies from the spectrum of the original sound in the region of 3840 Hz, thereby encoding the material with a 'notch' in the frequency spectrum so that a DAT recorder equipped with the system's decoding circuitry can sense the

presence of a prescribe notch in the spectrum and inhibit recording. The congressional questions and the NBS conclusions are: (1) Does the copy prevention system achieve its purpose. NBS Conclusion: The system does not achieve its stated purpose; (2) Does the system diminish the quality of the prerecorded material into which the notch is inserted. NBS Conclusion: The system's encoder alters the original electrical signal. For some listeners for some selections, the results in a discernible difference between prerecorded notched and unnotched material; (3) Can the system be bypassed and, if so, how easily. NBS Conclusion: The copy prevention system can be bypassed easily.

PHYSICS

Acoustics

801,137

PB88-174164

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Backprojection Reconstruction of Random Source Distributions.

Final rept., S. J. Norton, and M. Linzer. 1987, 9p
Pub. in Jnl. of Acoust. Soc. Am. 81, n4 p977-985 Apr 87.

Keywords: *Acoustic fields, Ultrasonic radiation, Sources, Algorithms, Reprints, Image reconstruction, Inverse problems, Backprojection.

A new approach to reconstructing intensity images of random source distributions is described. The technique requires multiple detecting transducers surrounding the source region, and employs a filtered-backprojection algorithm, similar in principle to that used in x-ray tomography, to process the detected source radiation. The detected signals from transducer pairs are cross-correlated prior to backprojection.

Fluid Mechanics

801,138

PB88-174776

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Thermodynamic Behavior of Supercritical Fluid Mixtures.

Final rept., J. M. H. Levett Sengers, G. Morrison, G. Nielson, R. F. Chang, and C. M. Everhart. 1986, 13p
Pub. in International Jnl. of Thermophysics 7, n2 p231-243 Mar 86.

Keywords: Aqueous electrolytes, Solubility, Extraction, Thermodynamic properties, Thermophysical properties, Critical point, Reprints, *Supercritical fluids.

The recent surge of interest in supercritical extraction has brought the unusual properties of supercritical mixtures into the focus of attention. The authors discuss some of the properties of binary mixtures in a range around the gas-liquid critical line from the point of view of supercritical solubility. The general thermodynamic relationships that govern the enhancement of supercritical solubility are readily derived by a mathematical method introduced by Ehrenfest. The enhancement is governed by a strong divergence (1) centered at a critical end point. They give the classical and nonclassical power-law behavior of the solubility along the experimental paths of constant temperature or pressure.

801,139

PB88-174818

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Thermodynamic Anomalies in Supercritical Fluid Mixtures.

Final rept., G. Morrison, J. M. H. Levett Sengers, R. F. Chang, and J. J. Christensen. 1985, 19p
Pub. in Supercrit. Fluid Technol., v3 p25-43 1985.

Keywords: *Stability criteria, Solubility, Thermodynamic properties, Reprints, *Supercritical fluids.

The authors use thermodynamic stability considerations, the Gibbs-Konowalow rule and properties of dilute near-critical mixtures to explain the striking features of the excess enthalpy versus composition curves studied along isotherm-isobars by Christensen and coworkers for a number of supercritical binaries. They show that knowledge of the supercritical enthalpy is essential for an understanding of supercritical solubility.

801,140

PB88-192281

PC A08/MF A01

California Inst. of Tech., Pasadena. Guggenheim Jet Propulsion Center.

Gravity Currents with Heat Transfer Effects.

M. V. Chobotov, E. E. Zukoski, and T. Kubota. Dec 86, 175p NBS/GCR-87/522
Grant NAMB-6-D0638
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Heat transfer, *Fluid flow, *Gravity, *Currents, *Fires, Models, Entrainment, Adiabatic conditions, Computer programs.

A two part experimental study of gravity currents flowing in horizontal channels is performed. The first of these examines adiabatic aqueous flows, and the second, heat transferring gaseous currents. A model of gravity current entrainment is presented. The effects of viscosity are examined in the transition from constant velocity flow to a decelerating, viscous dominated flow regime. To examine the effects which the reduction of buoyant forces due to heat loss has on gravity current flow, heated gaseous flows in another experimental facility are studied. Front velocities, layer thicknesses, wall heat fluxes, layer velocity and temperature profiles, and qualitative flow characteristics are recorded. The thermal front, with its constant channel-ceiling-temperature boundary condition, is found to decelerate as it moves downstream, while the layer thickness is seen to increase. Layer Richardson number is found to be constant along the steamwise direction of the flow, and an empirical relation of Nusselt number versus Reynolds number is obtained. Free convection in the form of longitudinal roll cells is shown to promote the high levels of heat transfer measured. A flow modeling scheme based on experimental observations is also developed.

801,141

PB88-193867

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Nonclassical Description of (Dilute) Near-Critical Mixtures.

Final rept., J. M. H. Levett Sengers, R. F. Chang, and G. Morrison. 1985, 22p
Pub. in ACS (American Chemical Society) Symposium Series 300, p110-131 1985.

Keywords: *Critical flow, Fluids, Mixtures, Thermodynamics, Dilution, Solubility, *Supercritical fluids, *Fluid mechanics, Vapor liquid equilibrium.

Reviewed is the nonclassical thermodynamic behavior of pure fluids and fluid mixtures particularly dilute ones, near critical points. For one-component fluids, accurate nonclassical formulations of the critical region are available, incorporating the vapor-liquid asymmetry as well as corrections to scaling. Empirical techniques for switching from classical to critical behavior have been worked out. The fundamental solution of the crossover problem has advanced to the point that application to one-component fluids is near. For binary mixtures a nonclassical formulation is available for the one-and-two-phase regions mixtures with continuous critical lines. A variety of nonclassical models have been used to represent coexisting phases. No attempts have been made to devise crossover functions.

801,142

PB88-195169

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Coherency Strain Induced Migration of Liquid Films Through Solids.

Final rept., D. N. Yoon, J. W. Cahn, C. A. Handwerker, J. E. Blendell, and Y. J. Baik. 1986, 13p
Pub. in Interface Migration and Control of Microstructure, p19-31 1986.

Keywords: *Sintering, *Liquid phases, Crystals, Solids, Interfaces, Migrations, Liquid alloys, Fluid mechanics, *Liquid-solid interfaces, Coherency strain.

A theory for migration of liquid films between crystals that are not in chemical equilibrium with the liquid is developed. The migration velocity is expressed in terms of well-defined physical parameters assuming local equilibrium at the solid-liquid interfaces. The principal factors causing material from one grain to dissolve and deposit on the other are coherency stresses due to compositional inhomogeneity. The initiation of migration is attributed in part to the elastic anisotropy. Loss of coherency at a grain surface on either side of a liquid film leads to steady state migration by dissolution of a coherent layer and growth of an incoherent one. Series of critical experiments have been performed to demonstrate that the liquid film migration arises from coherency strain. By changing the initial and final compositions, the coherency strain in ternary alloys are varied independently of the free energy of mixing. By applying liquid phase sintering techniques to Mo-Ni base ternary alloys, it is demonstrated that migration ceases as the coherency strain is reduced.

801,143

PB88-238506

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Thermally Induced Flow in a Confined Fluid. 1. Theoretical Concepts.

Final rept., V. Arp, and J. M. Persichetti. 1987, 10p
Pub. in International Communications Heat Mass Transfer 14, n5 p567-576 1987.

Keywords: *Axial flow, Compressible flow, Heat transfer, Perturbation, Acoustic velocity, Transient response, Reprints.

Heat transfer to a radially confined, compressible fluid is shown to induce large axial velocities. When expressed as a local, instantaneous Reynolds number, the velocity reaches 100,000 in one numerical example, seriously perturbing the radial velocity profile and the heat transfer process itself. The paper emphasizes sonic velocity effects in the analysis of the problem.

801,144

PB89-101307

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.

Static Structure Factor of a Soft Sphere Liquid Under Shear.

Final rept., J. C. Rainwater, H. J. M. Hanley, and S. Hess. 1988, 5p
Sponsored by Department of Energy, Washington, DC. Pub. in Physics Letters A 126, n8-9, p450-454, 25 Jan 88.

Keywords: *Couette flow, *Liquids, Non-Newtonian fluids, Shear properties, Reprints, Structure factors, Soft sphere liquids.

An expansion for the structure factor of a simple liquid undergoing planar Couette flow is extended to tensor rank four. The coefficients are evaluated by the methods of nonequilibrium molecular dynamics (NEMD) for a soft sphere fluid at 7/8 of its freezing density. Intensity plots are constructed, and it is shown that the fourth rank contribution to the structure factor is significant for a reduced shear rate of one.

801,145

PB89-107080

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Thermally Induced Convection in Narrow Channels. 2. Experimental Results for Refrigerant 113.

Final rept., J. M. Persichetti, W. G. Steward, and V. Arp. 1987, 12p
Pub. in International Communications in Heat and Mass Transfer 14, p687-698 1987.

PHYSICS

Fluid Mechanics

Keywords: *Heat transfer, *Convection, *Fluid dynamics, Unsteady flow, Nucleate boiling, Pressure gradients, Experimental data, Reprints, *Induced convection, *Refrigerant 113, Narrow channels.

Sudden heating of a fluid in a tube or narrow channel induces localized pressure gradients and transient flow which can significantly affect the heat transfer rate. Experiments with a long, pulse-heated tube containing refrigerant 113 produced induced flow as well as pressure oscillations. The paper presents experimental results, and analyses of the system.

801,146

PB89-126411 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
International Temperature Scales.

Final rept.,
B. W. Mangum. 1988, 4p
Pub. in ASTM (American Society for Testing and Materials) Standardization News, p36-39 May 88.

Keywords: *Temperature, *Standards, Temperature measuring instruments, Temperature measurement, Reprints, *International temperature scales.

This gives a very brief history of thermometry and temperature scales, especially the internationally-agreed-upon scales, and describes the new International Temperature Scale (ITS-90) that is to be implemented on 1 January 1990.

801,147

PB89-126932 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Scientific Computing Div.
Numerical Method for Acoustic Oscillations in Tubes.

Final rept.,
J. M. Gary. 1988, 10p
Pub. in International Jnl. for Numerical Methods in Fluids 8, n1 p81-90 Jan 88.

Keywords: *Numerical analysis, *Acoustic measurement, *Tubes, Helium, Eigenvalues, Pressure measurement, Perturbation theory, Reprints.

A numerical method to obtain the neutral curve for the onset of acoustic oscillations in a helium-filled tube is described. The tube might be inserted in a helium dewar. The problem is modeled by a second order, ordinary differential eigenvalue problem for the pressure perturbation. The numerical method to find the eigenvalues and track the resulting points along the neutral curve is tailored to the problem. The results show that a tube with a uniform temperature gradient along the tube is much more stable than one where the temperature suddenly jumps from the cold to the hot values in the middle of the tube.

Optics & Lasers

801,148

PB88-164066 PC A03/MF A01
National Bureau of Standards (NEL), Boulder, CO. Center for Electronics and Electrical Engineering.
Calibration and Standardization Issues for the Optical Time-Domain Reflectometer.
B. L. Danielson. Dec 87, 14p NBSIR-87/3078
Sponsored by Naval Weapons Station, Seal Beach, CA.

Keywords: *Reflectometers, *Calibration, Standardization, Optical communication, *Optical time domain reflectometers, Optical fibers.

Since its inception in 1976, the OTDR has developed rapidly into one of the most widely used and versatile test instruments for diagnostics in optical fiber communication systems. However, performance evaluation of these devices and related standards issues have lagged behind the technical development of the instrument itself. In the report the authors review some of the issues related to the specification and assurance of optical time-domain reflectometer (OTDR) performance. These include selection of appropriate performance parameters, definition of terms, test procedures, measurement difficulties, and use of standard reference fibers. Some recommendations are given for an OTDR calibration program.

801,149

PB88-169727 PC A05
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 93, Number 1, January-February 1988.

1988, 83p
Also available from Supt. of Docs. as SN703-027-00020-2. See also PB88-169735 through PB88-169776 and PB88-138516.

Keywords: *Standards, Irradiance, Far ultraviolet radiation, Phase meters, *Calibration, Light sources, Grid plates, US NBS.

Contents: The NBS scale of spectral irradiance; Radiometric calibrations of portable sources in the vacuum ultraviolet; Grid plate calibration at the National Bureau of Standards; Phase meter calibration at NBS; The application of flame spread theory to predict material performance.

801,150

PB88-169735 (Order as PB88-169727, PC A05)
National Bureau of Standards, Gaithersburg, MD.
NBS (National Bureau of Standards) Scale of Spectral Irradiance.
J. H. Walker, R. D. Saunders, J. K. Jackson, and D. A. McSparron. 1988, 14p
Included in Jnl. of Research of the National Bureau of Standards, v93 n1 p7-20 Jan-Feb 88.

Keywords: *Irradiance, *Standards, Optical measurement, Blackbody radiation, Radiometry, Error analysis, Calibration, Deuterium lamps, Uncertainty, US NBS.

The paper describes the measurement methods and the instrumentation used in the realization and transfer of the NBS scale of spectral irradiance. The basic measurement equation for the irradiance realization is derived. The spectral responsivity function, linearity of response, and 'size of source' effect of the spectroradiometer are described. The analysis of sources of error and the estimates of uncertainty are described. The assigned uncertainties (3 sigma level) in spectral irradiance range from 2.2% at 250 nm to 1.0% at 654.6 nm to 6.5% at 2400 nm.

801,151

PB88-169743 (Order as PB88-169727, PC A05)
National Bureau of Standards, Gaithersburg, MD.
Radiometric Calibrations of Portable Sources in the Vacuum Ultraviolet.
J. Z. Klose, J. M. Bridges, and W. R. Ott. 1988, 19p
Included in Jnl. of Research of the National Bureau of Standards, v93 n1 p21-39 Jan-Feb 88.

Keywords: *Far ultraviolet radiation, *Standards, Radiometry, Radiance, Irradiance, Portable equipment, Optical measurement, *Light sources, *Calibration, Deuterium lamps, US NBS.

The radiometric calibration program carried out by the vacuum ultraviolet radiometry group in the Atomic and Plasma Radiation Division of the National Bureau of Standards is presented in brief. Descriptions are given of the primary standards, which are the hydrogen arc and the blackbody line arc, and the secondary standards, which are the argon mini- and maxi-arcs and the deuterium arc lamp. The calibration methods involving both spectral radiance and irradiance are then discussed, along with their uncertainties. Finally, the calibration services are delineated in an appendix.

801,152

PB88-174834 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Phase Modulated Stimulated Raman Spectroscopy.
Final rept.,
G. J. Rosasco, and W. S. Hurst. 1985, 12p
Pub. in Jnl. of the Optical Society of America B 2, n9 p1485-1496 Sep 85.

Keywords: *Raman spectroscopy, Phase modulation, Methane, Deuterium, Helium, Nitrogen, Nonlinear systems, Reprints.

The authors discuss a technique for nonlinear Raman spectroscopy which uses two, orthogonally-polarized, frequency-degenerate pump waves whose relative phase is modulated. A phase modulated signal wave

results from the mixing of the pump waves and a probe wave via the third-order, nonlinear susceptibility ($\chi^{(3)}$). Heterodyne detection of the signal wave yields signals linear in ($\chi^{(3)}$), allows-shot-noise-limited sensitivities. Expressions for signal voltages are derived, and typical spectra are quantitatively analyzed.

801,153

PB88-175211 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Infrared Spectrum of GeO.
Final rept.,
G. A. Thompson, A. G. Maki, and A. Weber. 1986, 7p
Pub. in Jnl. of Molecular Spectroscopy 116, n1 p136-142 1986.

Keywords: *Diode laser spectroscopy, *Germanium oxide, Infrared spectroscopy, Reprints.

The high temperature infrared spectrum of the $v=1$ sequence of GeO has been investigated from 882 to 955 cm^{-1} with a tunable diode laser spectrometer. Transitions from $(70)\text{Ge}(16)_0$, $(72)\text{Ge}(16)_0$, $(73)\text{Ge}(16)_0$, $(74)\text{Ge}(16)_0$ and $(76)\text{Ge}(16)_0$ were measured for vibrational transitions from $v=1-0$ to $v=6-5$ and fit to a single set of 8 Dunham potential coefficients.

801,154

PB88-175658 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
High Precision Measurements of Doppler-Free Two-Photon Transitions in Rb: New Values for Proposed Dye Laser Reference Wavelengths.
Final rept.,
C. J. Sansonetti, and K. H. Weber. 1985, 7p
Pub. in Jnl. of the Optical Society of America B 2, n9 p1385-1391 Sep 85.

Keywords: *Wavelengths, Electron transitions, Optical measurement, Reprints, *Laser radiation, *Rubidium 85, Iodine 127, Laser spectroscopy, Dye lasers, Multi-photon processes.

Doppler-free two-photon transitions in alkali metals have been suggested as precise reference lines for laser wavelength calibration. The authors have made new measurements of the $(85)\text{Rb}$ 5s-ns transitions ($n=14-50$) with estimated accuracy better than 1 part in 100 million. The wavelength of our dye laser was measured by using classical Fabry-Perot interferometry. Their results differ systematically from the most precise previous measurements which were made by using a traveling Michelson wavemeter. The observed discrepancies cannot be explained by known systematic shifts of the Rb levels in the thermionic diode detectors employed in both experiments. They have confirmed the accuracy of our interferometric wavelengths by measuring Doppler-free saturated absorption lines in $(127)\text{I}_2$. These results raise questions about the accuracy of recent Rydberg state measurements in Li, K, Rb, and Cs which were calibrated with respect to the previous measurements of the $(85)\text{Rb}$ 5s-ns transitions.

801,155

PB88-176847 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Detection of Spectrally Narrow Light Emission by Laser Intra-Cavity Spectroscopy.
Final rept.,
V. M. Baev, K. J. Boller, A. Weiler, and P. E. Toschek. 1987, 5p
Pub. in Optics Communications 62, n6 p380-384, 15 Jun 87.

Keywords: Reprints, *Laser spectroscopy, Laser outputs, Multimode.

The spectral distribution of the output of a multimode laser is extremely sensitive to narrow-band absorption, gain, or light injection. The authors demonstrate redistribution in such output spectra to depend on the time delay of the injection. The effect seems to be useful for spectrally resolved detection of weak light signals.

801,156

PB88-176953 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Absorption Spectroscopy at the Limit: Detection of a Single Atom.

Final rept.,
D. J. Wineland, W. M. Itano, and J. C. Bergquist.
1987, 3p
Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Optics Letters 12, n6 p389-391 Jun 87.

Keywords: *Atoms, Light transmission, Sensitivity, Reprints, *Atomic ions, *Absorption spectroscopy, Laser spectroscopy, Laser cooling, Ion storage.

The authors investigate the sensitivity limit of absorption spectroscopy. An experiment is described in which the decrease in transmitted light intensity that is due to absorption by a single, electromagnetically confined atomic ion is observed.

801,157
PB88-177399 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Resonance Transitions in the Mg I and Ar I Isoelectronic Sequences from Cu to Mo.

Final rept.,
J. Sugar, V. Kaufman, and W. L. Rowan. 1987, 4p
Sponsored by Department of Energy, Washington, DC. Office of Magnetic Fusion Energy, and Naval Research Lab., Washington, DC.
Pub. in Jnl. of the Optical Society of America B 4, n12 p1927-1930 Dec 87.

Keywords: *Arsenic, *Bromine, *Copper, Gallium, Germanium, Isoelectronic sequence, Krypton, Molybdenum, Reprints.

New measurements for the transitions 3s(2)1S0-3s3p(1)3P(1) in the Mg I isoelectronic sequence and for 3s(2)3p(6)1S0-3s(2)3p(5)3d(1)P(1) and (3)D(1) in the Ar I sequence are given for most of the elements from Cu to Mo. These measurements are compared with uniformly scaled relativistic Hartree-Fock calculations, and the wavelength differences are fit to a continuous function from which new smoothed values are derived with an estimated uncertainty of + or - 0.005 Angstroms.

801,158
PB88-177423 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

In I Isoelectronic Sequence: Wavelengths and Energy Levels for Xe VI Through La IX.

Final rept.,
V. Kaufman, and J. Sugar. 1987, 3p
Sponsored by Department of Energy, Washington, DC. Office of Magnetic Fusion Energy.
Pub. in Jnl. of the Optical Society of America B 4, n12 p1924-1926 Dec 87.

Keywords: *Barium, *Cesium, Energy levels, Lanthanum, Wavelengths, Xenon, Reprints.

Spectra of Xe, Cs, Ba, and La produced with a high-voltage spark discharge were observed photographically with the National Bureau of Standards 10.7-m normal- and grazing-incidence spectrographs. Identified lines of the In I isoelectronic sequence were used to determine the energy levels of the 5s(2)5p, 5s5p(2), 5s(2)5d, and 5s(2)6s configurations. Their interactions with unobserved configurations that include a 4f electron are discussed. Fitted values of the radial energy integrals were determined from the known levels.

801,159
PB88-177548 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Dosimetry of Steady-State Gamma Rays or Pulsed X-rays Using Liquid-Core Optical Waveguides.

Final rept.,
B. B. Radak, W. L. McLaughlin, M. G. Simic, and W. Warasawas. 1987, 9p
Pub. in Radiation Physics and Chemistry 30, n4 p243-251 1987.

Keywords: *Dosimetry, *Flash photolysis, Gamma radiation, Reprints, Liquid core fiber optics, Optical waveguides, Pulsed beams.

A liquid-core optical waveguide (OWG) sensor of ionizing radiation can be used for dosimetry over broad absorbed-dose ranges, by means of a relatively simple experimental arrangement. The analyzing visible light

from one of several narrow wavelength-band sources at the proximal end of the OWG is propagated efficiently through a tightly coiled waveguide containing a radiochromic solution. The solution constitutes the sensor and attenuates the measuring light according to the simple Beer-Lambert relationship, where increases in the optical absorbance, measured photometrically at the distal end of the OWG, are proportional to the concentrations of the radiation-induced absorbing species (dye molecules), which in turn are proportional to the absorbed dose in the sensor. When the analyzing light is of broad spectral distribution, the absorbance vs dose relationship becomes sublinear. The apparatus may be adapted either to the spectrophotometric measurement of absorbed dose rate or integrated absorbed dose during gamma radiolysis or to dosimetry in the pulse radiolysis or flash photolysis of radiation-stimulated chromophores. The OWG principle works with any transparent liquid or gel sensor held as the core material of a flexible plastic tubing, whose refractive index is less than that of the light-propagating core.

801,160
PB88-187620 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Scanning Tunneling Microscopy (STM) of a Diamond-Turned Surface and a Grating Replica.

Final rept.,
R. A. Dragoset, and T. V. Vorburger. 1987, 5p
Pub. in SPIE (Society of Photo-Optical Instrumentation Engineers) 749--Metrology: Figure and Finish, p54-58 1987.

Keywords: *Surface roughness, *Optical measurement, Gratings(Spectra), Mirrors, Metrology, Comparison, Turning(Machining), Diamonds, Reprints, Scanning tunneling microscopy.

The technique of scanning tunneling microscopy has been applied to topographic mapping of two optical surfaces -- a ruled grating replica and a diamond-turned gold mirror. By taking measurements with both a scanning tunneling microscope and a conventional stylus instrument, the authors have compared profiles and power spectral density (PSD) functions calculated from the profiles of a grating replica. Furthermore, surface structure was observed and PSD's were calculated for a diamond-turned surface measured with a STM. No structure was detected by the stylus instrument due to the spacing of the grooves on the diamond-turned sample. These measurements yield information necessary to gaining a better understanding of the diamond-turning process.

801,161
PB88-188495 Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Frequency Stabilization of Semiconductor Lasers by Resonant Optical Feedback.

Final rept.,
B. Dahmani, L. Hollberg, and R. Drullinger. 1987, 3p
Pub. in Optics Letters 12, n11 p876-878 Nov 87.

Keywords: *Semiconductor laser, *Frequency stability, Stabilization, Line width, Feedback, Reprints.

With simple optical geometries, a separate resonant Fabry-Perot cavity can serve as an optical feedback element that forces a semiconductor laser automatically to lock its frequency optically to the cavity resonance. This method is used to stabilize laser frequencies and reduce linewidths by a factor of 1000 from 20 MHz to approximately 20 kHz.

801,162
PB88-189329 Not available NTIS

National Bureau of Standards (NML), Washington, DC. Molecular Spectroscopy Div.

High-Resolution Measurements of the (nu sub 2) Band of HNO3 and the (nu sub 3) Band of trans-HONO.

Final rept.,
A. G. Maki. 1988, 8p
Pub. in Jnl. of Molecular Spectroscopy 127, p104-111 1988.

Keywords: Nitric acid, Nitrous acid, Pollution, Spectra, Reprints, *Absorption, Infrared, Intensity, *Molecular spectra, *Lasers.

New tunable diode laser measurements of the upsilon-on2 band of HNO3 from 1688 to 1737 cm-1 are used to derive an improved set of rovibrational constants.

When these constants are used to calculate the spectrum in the region from 1660 to 1750 cm-1 the calculated spectrum matches very closely the observed spectrum in both line position and relative intensity. Improved rovibrational constants are also reported for the upsilon3 band of trans-HONO as a result of diode laser measurements in the region 1222 to 1266 cm-1. The subbands with Ka = 10 thru 14 show signs of a weak perturbation that systematically displaces the transitions by small amounts (up to 0.05 cm-1).

801,163
PB88-189600 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.

Direct Comparison of Mechanical and Optical Measurements of the Finish of Precision Machined Optical Surfaces.

Final rept.,
E. L. Church, T. V. Vorburger, and J. C. Wyant. 1984, 12p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) Int. Soc. Opt. Eng. 508, p71-82 1984.

Keywords: *Surface roughness, *Optical measurement, Optical equipment, Microscopy, Germanium, Silicon, Comparison, Turning(Machining), Diamonds, Reprints, Interferometry.

The paper compares two methods of measuring the finish of precision-machined optical surfaces: the order and well-established use of a mechanical stylus gauge (Talystep) and the recently developed optical technique based on interference microscopy (Wyko NCP). Results are found to be in good quantitative agreement for both random and periodic surface features providing appropriate filtering procedures are included in the data analysis to account for the differing transfer functions and bandwidths of the two measurement techniques. These results affirm the use of these techniques for the quantitative measurement and specification of machined optical-surfaces.

801,164
PB88-189972 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.

Measurements of Roughness of Very Smooth Surfaces.

Final rept.,
T. V. Vorburger. 1987, 7p
Pub. in Annals of the CIRP 36, n2 p503-509 1987.

Keywords: *Surface roughness, *Optical measurement, Optical equipment, Metrology, Profiles, Resolution, Reprints, Scanning tunneling microscopy.

The paper reviews the rapid developments in profiling techniques for the measurement of roughness of very smooth surfaces, particularly those used in optical components. Three classes of techniques are discussed: stylus methods, optical profiling, and scanning tunneling microscopy (STM); and key factors are the vertical and lateral ranges of the various instruments. In the field of optical profiling, the authors have seen the development of at least four types of unique instruments with vertical resolution of 0.1 nm or less, slightly superior to that of the stylus instrument. However, the latter still seems to have superior lateral resolution. By comparison, STM has atomic lateral resolution and subatomic vertical resolution, so it is a revolutionary advance in surface profiling for certain applications.

801,165
PB88-190194 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.

Gray Scale of Diffuse Reflectance for the 250-2500 nm Wavelength Range.

Final rept.,
V. R. Weidner. 1986, 2p
Pub. in Applied Optics 25, n8 p1265-1266 1986.

Keywords: *Reflectance, Near infrared radiation, Near ultraviolet radiation, Carbon black, Reprints, Spectral reflectance, Gray scale, Visible radiation, Polytetrafluoroethylene.

A gray scale of diffuse reflectance for the wavelength range 250-2500 nm has been developed in 16 reflectance levels ranging between approximately 3 percent and 90 percent. The gray scale is produced by a process in which mixtures of carbon black and polytetra-

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fluoroethylene (PTFE) resin are sintered at a temperature of 370 C.

801,166

PB88-190210 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Radiometric Physics Div.
Sintered Mixtures of Phosphors in Polytetrafluoroethylene (PTFE) Resin for Fluorescence Standards.
Final rept.,
V. R. Weidner, R. Mavrodineanu, and K. L. Eckerle.
1986, 2p
Pub. in *Applied Optics* 25, n6 p832-833 1986.

Keywords: Reprints, *Fluorescence, Emission spectra, Phosphors, *Polytetrafluoroethylene, Sintering.

Sintered mixtures of phosphors in polytetrafluoroethylene (PTFE) resin are being prepared and analyzed for possible use as standards for fluorescence measurements. The inorganic phosphors exhibit emission spectra in the blue, green, yellow, and orange wavelength regions of the visible spectrum. When combined with the PTFE powder and sintered at 370 C, these components form a durable fluorescent material. These materials are stable when exposed to ultraviolet radiation. NBS is continuing the analysis of the sintered specimens to include investigations into the effects of phosphor concentration, and variations in excitation wavelengths on the emission spectra.

801,167

PB88-194287 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Radiation Source and Instrumentation Div.
Proposal for FEL (Free Electron Lasers) Experiments Driven by the National Bureau of Standards CW Microtron.
Final rept.,
C. M. Tang, P. Sprangle, S. Penner, B. M. Kincaid, and R. R. Freeman. 1986, 5p
See also AD-A163 227.
Pub. in *Proceedings of International Conference on Free Electron Lasers* (7th), Tahoe City, CA., September 8-13, 1985, p278-282 1986.

Keywords: Infrared radiation, Ultraviolet radiation, *Free electron lasers, Microtrons, US NBS, Visible radiation.

The authors propose FEL experiments driven by the racetrack microtron (RTM), which is under development at the National Bureau of Standards (NBS). The authors also propose accelerator up-grades to increase the peak current and to recover a significant part of the electron beam energy. Low gain calculations indicate that the FEL can oscillate at the fundamental wavelength ranging from 0.15 micrometer to 100 micrometers. Experiments are outlined to generate harmonic in the XUV.

801,168

PB88-198007 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Atomic and Plasma Radiation Div.
Revisions in La XI and La XII Based on Comparison with Scaled Hartree-Fock Calculations.
Final rept.,
V. Kaufman, and J. Sugar. 1988, 1p
Pub. in *Jnl. of the Optical Society of America B* 5, p730 Mar 88.

Keywords: Electron transitions, Hartree-Fock approximation, Reprints, *Lanthanum ions, Isoelectronic sequence.

Calculations of transitions in the Pd I and Ag I isoelectronic sequences prompted reclassification of three lines of La XI and La XII.

801,169

PB88-198866 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD, Precision Engineering Div.
Dark-Field Microscopy of Transparent Objects with a Bright-Field Objective.
Final rept.,
A. W. Hartman. 1988, 2p
Pub. in *Review of Scientific Instruments* 59, n3 p502-503 Mar 88.

Keywords: *Microscopy, Reprints, Dark field microscopy.

Described is a simple modification of a standard bright-field objective to produce dark-field imagery of transparent objects.

801,170

PB88-201595 PC A04/MF A01
National Bureau of Standards (NML), Gaithersburg, MD, Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: The NBS Photodetector Spectral Response Calibration Transfer Program.
Special pub. (Final),
E. F. Zalewski. Mar 88, 66p NBS/SP-250/17
Also available from Supt. of Docs. Library of Congress catalog card no. 88-600509.

Keywords: *Photodetectors, *Radiometry, Photodiodes, Silicon, Quantum efficiency, Near infrared radiation, Near ultraviolet radiation, Photoelectric emission, *Calibration, Spectral response, Visible radiation, US NBS.

A silicon-photodiode-based radiometer is supplied to transfer the calibration of absolute spectral response in units of A/W (Amperes/Watt) and A sq cm/W in the 250 to 1064 nm region of the spectrum. The radiometer is also characterized for linearity over the four-decade range of the amplifier gain settings. Also included with the radiometer are components and a procedure for measurement error diagnosis. The methods for obtaining and using this calibrated radiometer are described, as well as the calibration and characterization procedures used at NBS.

801,171

PB88-205273 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD, Building Materials Div.
Safety Color Appearance Under Different Illuminants.
Final rept.,
B. L. Collins. 1987, 18p
See also PB87-152294. Sponsored by Occupational Safety and Health Administration, Washington, DC.
Pub. in *Jnl. of the Illuminating Engineering Society* 16, n1 p21-38 1987.

Keywords: *Colors, *Illumination, Safety, Fluorescent lamps, Mercury lamps, Incandescent lamps, Sodium lamps, Specifications, Chromaticity, Luminance, Reprints, *ANSI standard safety colors.

The present report provides data on the color appearance and physical measurements of 58 safety color samples viewed under each of seven light sources. Ten observers participated in an experiment which determined the accuracy with which different color samples could be identified under sources which varied in spectral composition. The seven light sources included incandescent, cool white fluorescent, clear mercury, metal halide, metal halide-high pressure sodium mix, high pressure sodium, and low pressure sodium. Color samples included ones for safety red, orange, yellow, green, blue, purple (magenta), brown, white, gray, and black of several different types including ordinary, fluorescent, retroreflective, and retroreflective fluorescent. Analysis of the data indicated that the standard ANSI (American National Standards Institute) samples were often not identified accurately under many of the sources studied, with particularly poor performance for the two sodium sources and clear mercury. Specifications are given for a new set of samples that were identified more accurately under all seven sources and which showed a greater gamut of coloration in a uniform color space for all sources.

801,172

PB88-217997 Not available NTIS
National Bureau of Standards (NML), Boulder, CO, Quantum Physics Div.
Frequency Stability Measurements on Polarization-Stabilized He-Ne Lasers.
Final rept.,
T. M. Niebauer, J. E. Faller, H. M. Godwin, J. L. Hall, and R. L. Barger. 1988, 5p
Sponsored by National Geodetic Survey, Rockville, MD., Defense Mapping Agency, Washington, DC., and Air Force Geophysics Lab., Hanscom AFB, MA.
Pub. in *Applied Optics* 27, n7 p1285-1289, 1 Apr 88.

Keywords: *Helium neon lasers, *Frequency stability, Polarization(Waves), Reprints.

The authors present detailed stability measurements on six He-Ne lasers which have been stabilized by matching the intensity of the two orthogonal polariza-

tion modes. The frequencies of five different lasers were closely monitored for 1 month. Another laser was studied for 2 yr. All the lasers exhibited a stability of 1 part in 10 billion over the periods of about an hour and better than 1 part in 100 million over 1 yr. An absolute accuracy of about 1 part in 10 billion can be attained by interpolating the linear drift between calibrations performed 6 months to 1 yr apart. These 1-mW lasers are rugged and simple to operate.

801,173

PB88-225685 PC A04/MF A01
National Bureau of Standards (NML), Boulder, CO, Time and Frequency Div.
Investigation of the Hydrogen Source for Masers,
Technical note (Final),
K. B. Persson, and F. L. Walls. Apr 88, 58p NBS/TN-1315
Also available from Supt. of Docs as SN003-003-02870-3 Sponsored by Naval Research Lab., Washington, DC.

Keywords: *Masers, Atomic beams, Detectors, Dissociation, Sources, *Hydrogen masers, Hydrogen atoms, Satellite-borne instruments, Lifetime, Recombination, Radio frequency discharge.

Various engineering and phenomenological aspects of the radio frequency discharge source for atomic hydrogen used in the masers have been investigated theoretically and experimentally to provide a base for minimizing the size of the source and its power consumption. A scheme and detector have been devised, permitting absolute detection of the atomic beam, and an atom-atom surface recombination theory was developed, applicable to the detector as well as to the walls of the discharge vessel. A self-starting radio frequency circuit, allowing as little as 0.1 W power consumption by the atom source, has been developed.

801,174

PB88-237375 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Atomic and Plasma Radiation Div.
Spectra of Highly-Ionized Atoms.
Final rept.,
J. Reader, J. Sugar, and V. Kaufman. 1988, 5p
Sponsored by Strategic Defense Initiative Organization, Washington, DC., Naval Research Lab., Washington, DC., and Department of Energy, Washington, DC.
Office of Magnetic Fusion Energy.
Pub. in *SPIE (Society of Photo-Optical Instrumentation Engineers): Short and Ultrashort Wavelength Lasers*, v875 p66-70 1988.

Keywords: *Atomic spectra, Reprints, X ray lasers, Isoelectronic sequence, Laser-produced plasma, Tokamak devices.

Recent work on the spectra of laser-produced plasmas and tokamaks has led to the observation of long sequences of isoelectronic ions extending to very high ionic charge states. The measurements of the wavelengths and energy levels provide data that are important for the development of x-ray lasers. In addition to contributing to a knowledge of the energy levels and transitions of possible lasing media, the data provide reference lines for wavelength calibration of x-ray laser experiments and reference data for testing theoretical methods used for predicting the properties of lasing ions.

801,175

PB88-238589 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Radiation Source and Instrumentation Div.
RF Linac Based Free Electron Lasers.
Final rept.,
S. Penner. 1987, 6p
Pub. in *Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Particle Accelerator Conference*, Washington, DC., March 16-19, 1987, p183-188.

Keywords: Linear accelerators, Electron beams, *Free electron lasers.

An RF linear accelerator is a good choice for the electron beam source in a short wavelength FEL because of the relative ease of achieving high energy while maintaining small transverse emittance and energy spread. The electrical efficiency of RF linac FELs can be very high compared to other types of lasers, and it can be further improved by recapturing a large fraction of the energy of the electron beam after it has passed through the FEL.

801,176

PB88-248323 PC A25/MF A01

National Bureau of Standards, Boulder, CO.

Laser Induced Damage in Optical Materials: 1985. Special pub. (Final).

H. E. Bennett, A. H. Guenther, D. Milam, and B. E. Newnam. Jul 88, 580p NBS/SP-746

Also available from Supt. of Docs. as SN003-003-02877-1. Library of Congress catalog card no. 88-600557. Prepared in cooperation with American Society for Testing and Materials, Philadelphia, PA., Office of Naval Research, Arlington, VA., Department of Energy, Washington, DC., and Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Optical materials, Optical equipment, Thin films, Meetings, Optical properties, Substrates, Coatings, *High power lasers, *Laser damage.

The Seventeenth Annual Symposium on Optical Materials for High-Power Lasers (Boulder Damage Symposium) was held at the National Bureau of Standards in Boulder, Colorado, October 28-30, 1985. The Symposium was divided into sessions concerning Materials and Measurements, Mirrors and Surfaces, Thin Films, and Fundamental mechanisms. As in previous years, the emphasis of the papers presented at the Symposium was directed toward new frontiers and new developments. Particular emphasis was given to materials for high-power apparatus. The wavelength range of prime interest was from 10.6 micrometers to the ultraviolet region. Highlights included surface characterization thin film-substrate boundaries, and advances in fundamental laser-matter threshold interactions and mechanisms.

801,177

PB89-107098Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.**Optical Microscope Imaging Lines Patterned in Thick Layers with Variable Edge Geometry: Theory.**Final rept.,
D. Nyyssonen, and C. P. Kirk. 1988, 11p
Pub. in Jnl. of the Optical Society of America A 5, n8 p1270-1280 Aug 88.

Keywords: *Line width, *Dimensional measurement, Optical microscopes, Optical images, Optical measurement, Integrated circuits, Metrology, Models, Reprints, Micrometrology.

A monochromatic waveguide model that can predict the optical microscope images of line objects with arbitrary edge geometry is presented. The lines may be patterned in thick layers, including multilayer structures with sloping, curved, and undercut edges; granular structures such as lines patterned in polysilicon; and asymmetric objects. The model is used to illustrate the effects of line edge structure on the optical image. Qualitative agreement with experimentally obtained optical image profiles is demonstrated. Application of the model to studying the effects of variations in layer thickness and edge geometry on linewidth measurements made at different stages of manufacturing integrated-circuit devices is discussed.

801,178

PB89-123756Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.**Laser Stabilization at the Millihertz Level.**Final rept.,
C. Salomon, D. Hils, and J. L. Hall. 1988, 12p
Sponsored by National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA. Pub. in Jnl. of the Optical Society of America B 5, n8 p1576-1587, Aug 88.

Keywords: *Stabilization, Frequency standards, Reprints, *Lasers, *Laser linewidth, Birefringence.

The main task of the paper is to identify a number of physical problems that must be successfully addressed to achieve stabilized laser linewidths well below 1 Hz. After presentation of the basic stability characteristics of available laser sources, the authors show that if any of these lasers were optimally locked to a high-finesse Fabry-Perot cavity it would be theoretically possible to obtain a laser linewidth in the millihertz domain. Problems of optical feedback, modulation waveform errors, mechanical support and isolation of the reference cavity, thermal stabilization of the environment, etc. are considered, and interim solu-

tions are discussed. Experimentally, locking accuracy to successive cavity orders of less than 2×10^{-6} linewidths (\pm or -1.5 Hz) was achieved; mirror birefringence pulled the lock point approximately 10-fold more. Relative phase coherence between two independent lasers locked onto adjacent cavity orders was preserved for 8 sec, corresponding to a linewidth of each optical source of about 50 mHz.

801,179

PB89-123798Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.**Doppler-Free Optical Multiplex Spectroscopy with Stochastic Excitation.**Final rept.,
K. P. Dinse, M. Winters, and J. L. Hall. 1988, 7p
Grants NSF-PHY86-04504, N00014-85-0816
Sponsored by National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA. Pub. in Jnl. of the Optical Society of America B 5, n9 p1825-1831 Sep 88.

Keywords: Optical spectrometers, Stochastic processes, Argon lasers, Excitation, Precision, Reprints, *Optical multiplex spectroscopy.

By using the concept of stochastic excitation, a multi-channel optical spectrometer was developed with an inherent spectral resolution in the kilohertz domain. Stochastic optical fields are obtained by phase modulating a frequency-stabilized $\text{Ar}(1+)$ laser with a pseudorandom binary sequence. This sequence is characterized by an autocorrelation time of 5 nsec, with a resulting excitation bandwidth of approximately 200 MHz. A signal related to an optical free-induction decay is obtained after cross correlating the response of the system with the time-delayed stochastic excitation sequence. The performance of the spectrometer was demonstrated by observing Doppler-free transitions of molecular iodine.

801,180

PB89-126353Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.**Precise Optical Spectroscopy with Ion Traps.**Final rept.,
W. M. Itano, J. C. Bergquist, R. G. Hulet, and D. J. Wineland. 1988, 6p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA. Pub. in Physica Scripta T22, p79-84 1988.

Keywords: Reprints, *Laser spectroscopy, *Ion traps, *Mercury ions, Magnesium ions, Laser cooling, Double resonance methods, Radioactive lifetime.

The authors have used stored ion methods to improve resolution and sensitivity in optical spectroscopy. Single atomic ions have been confined by electric and magnetic fields, cooled by laser radiation pressure to temperatures on the order of 1 mK, and probed spectroscopically with narrowband lasers. The absorption resonance of a single $\text{Hg}(1+)$ ion has been observed by a decrease in the transmitted light intensity. An ultraviolet transition in $\text{Hg}(1+)$ has been observed with a linewidth of only 3 kHz. Quantum jumps to and from metastable levels of $\text{Hg}(1+)$ have been observed and used to determine radiative decay rates and to infer the existence of photon antibunching. Quantum jumps have also been observed in single $\text{Mg}(1+)$ ions.

801,181

PB89-126379Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.**Frequency Measurements of Far Infrared (12)CH₃OH Laser Lines.**Final rept.,
E. C. C. Vasconcellos, J. Wyss, and K. M. Evenson. 1987, 5p
Pub. in International Jnl. of Infrared and Millimeter Waves 8, n6 p647-651 Jun 87.

Keywords: *Frequency measurement, Far infrared radiation, Submillimeter waves, Optical pumping, Carbon dioxide lasers, Continuous radiation, Polarization(Waves), Reprints, *Laser radiation, *Methyl alcohol lasers, Waveguide lasers.

The authors have measured the frequencies of 12 known and 3 new submillimeter laser lines obtained by pumping (12)CH₃OH with a cw-waveguide CO₂ laser in a Fabry-Perot FIR resonator. The authors have also

measured the relative polarization and the pumping CO₂ frequency offset for each line.

801,182

PB89-129548PC A99/MF E04
National Inst. of Standards and Technology, Boulder, CO.**Laser Induced Damage in Optical Materials: 1986.** Special pub. (Final).H. E. Bennett, A. H. Guenther, D. Milam, and B. E. Newnam. Sep 88, 726p NIST/SP-752
Also available from Supt. of Docs. See also PB88-248323. Library of Congress catalog card no. 88-600571. Prepared in cooperation with American Society for Testing and Materials, Philadelphia, PA., Office of Naval Research, Arlington, VA., Department of Energy, Washington, DC., and Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Optical materials, *Meetings, Optical equipment, Thin films, Optical properties, Substrates, Coatings, *High power lasers, *Laser damage.

The Proceedings contain the papers presented at the Eighteenth Symposium on Optical Materials for High Power Lasers held at the National Bureau of Standards in Boulder, Colorado, on November 3-5, 1986.

801,183

PB89-129555PC A10/MF A01
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.**Technical Digest-Symposium on Optical Fiber Measurements, 1988.**Special pub. (Final),
G. W. Day, and D. L. Franzen. Sep 88, 201p NBS/SP-748
Also available from Supt. of Docs. See also PB87-133294. Library of Congress catalog card no. 88-600561. Prepared in cooperation with Optical Society of America, Washington, DC.

Keywords: *Fiber optics, *Meetings, Optical measurement.

The digest contains summaries of 42 papers presented at the Symposium on Optical Fiber Measurements, held September 20-21, 1988, at the National Bureau of Standards, Boulder, Colorado.

801,184

PB89-137558Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.**Bright-Field Image Correction Using Various Image-Processing Tools.**Final rept.,
D. S. Bright, and E. B. Steel. 1986, 4p
Pub. in Microbeam Analysis-1986, p517-520.

Keywords: Images, Correction, *Electron microscopy, Background, *Optical filters, Illuminance, Optical microscopes, Detectors, Computation, Reprints, *Image correction, *Image processing, Bright field.

Elementary calculations show that a bright field or transmission mode image may be corrected for uneven background illumination and non-uniform detector sensitivity by dividing the image by a background or blank image. Examples are given for light microscopy and electron microscopy. If the objects in the image are sufficiently thin or small, the background image may be generated from the sample image by using a maximum filter. This is useful when blank images are not easily obtained instrumentally. Small scale debris can be selected by a topat filter and removed by replacing them with corresponding pieces of the blank image. An example from light microscopy is given.

Plasma Physics

801,185

PB88-189964Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

PHYSICS

Plasma Physics

Ion Broadening of Heavy Element Lines in Plasmas.

Final rept.,
W. L. Wiese, and D. W. Jones. 1987, 19p
Pub. in Spectral Line Shapes, v4 p3-21 1987.

Keywords: *Plasmas(Physics), Reprints, *Line broadening, Heavy ions, Ion Broadening.

Recent experimental studies on the ion broadening of heavy element lines in plasmas are reviewed, and the principal results are discussed and compared with theory. According to line broadening theory, isolated lines of neutral atoms in dense plasmas are broadened predominantly by electron collisions and symmetrical Lorentzian profiles are the result. The plasma ions provide additional small contributions to the broadening which are asymmetrical in nature. The difference in symmetries provides the opportunity to isolate some aspects of the ion broadening from the electron broadening.

801,186

PB88-194964

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Spectra of Se XVI to Se XXIV Observed in a Tokamak Plasma.

Final rept.,
J. Sugar, V. Kaufman, and W. L. Rowan. 1988, 7p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of the Optical Society of America B 5, n2 p236-242 Feb 88.

Keywords: Atomic spectra, Plasmas(Physics), Reprints, *Selenium ions, TEXT devices, Tokamak devices.

Selenium was injected into the plasma of the Texas Experimental Tokamak by laser ablation. Spectra of Se ions stripped to the $n = 3$ shell were observed photographically with a 2.2-m vacuum spectrograph. Classifications of 60 lines arising from K-like to Na-like ions were determined. A wavelength accuracy of plus or minus 0.010 Å was obtained by calibration with internally generated Fe spectra.

801,187

PB88-204581

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Discharges at Extremely High Values of E/n and Low Currents.

Final rept.,
A. V. Phelps. 1988, 8p
Pub. in Proceedings of the International Conference on Phenomena in Ionized Gases (18th), Swansea, Wales, July 13-17, 1987, p2-9 1988.

Keywords: *Electric discharges, *Dielectric breakdown, Electric fields, *Breakdown(Electronic threshold).

The authors interest in electrical discharges and breakdown at very high ratios of the electric field to gas density E/n in spatially uniform electric fields originally arose from the opportunity the investigation of such phenomena offers for the development and testing of models of the motion of electrons at sufficiently large E/n that departures from the local equilibrium or hydrodynamic models are important. When the interpretation of the experiments indicated that collisions of fast ions and fast neutrals with the gas are important, the authors were faced with the challenge of developing and testing quantitative experiments and models characterizing the behavior of these species. The understanding of the motion of electrons, ions, and their products at high E/n in a spatially uniform electric field is fundamental to the understanding and modeling of their behavior in the nonuniform and time varying electric fields of the cathode fall, low pressure rf discharges, Tokamak type device startup, and the high field regions of semiconductors.

801,188

PB88-237383

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Collisional Broadening of the Balmer-alpha Transition of H and He(1+) in Plasmas.

Final rept.,
D. H. Oza, R. L. Greene, and D. E. Kelleher. 1988, 6p
Sponsored by Air Force Office of Scientific Research, Arlington, VA.
Pub. in Physical Review A 37, n2 p531-536, 15 Jan 88.

Keywords: *Plasmas(Physics), *Hydrogen, Stark effect, Reprints, *Helium ions, *Balmer lines, Line broadening.

The authors have computed the Stark-broadened width of the H(alpha) transition of neutral hydrogen and singly ionized helium at several plasma temperatures. Their calculations include dynamical contributions of perturbing ions, which dominated the widths of this important transition, particularly at lower electron densities. They compare their results for neutral hydrogen with experimental results over a span of two decades in electron density, and excellent agreement is obtained.

Radiofrequency Waves

801,189

PB88-175484

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

Observation of Microwave Cerenkov Radiation as a Diffraction Pattern.

Final rept.,
X. K. Maruyama, J. R. Neighbours, F. R. Buskirk, D. D. Snyder, M. Vujaklija, and R. G. Bruce. 1986, 3p
See also AD-A159 337.
Pub. in Jnl. of Applied Physics 60, n2 p518-520, 15 Jul 86.

Keywords: *Microwave radiation, Reprints, *Angular distribution, *Diffraction pattern, Electron bunches.

Measurement of microwave Cerenkov radiation in air exhibits the diffraction pattern predicted in earlier work. The radiation appears only at harmonics of the frequency of periodic electron bunches. Angular distribution power measurements are presented for frequencies of 2.86, 5.71, 8.57, and 11.42 GHz corresponding to the fundamental and the first three harmonics of an S band RF linac.

Solid State Physics

801,190

PB88-173919

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Icosahedral Symmetry in a Metallic Phase Observed by Field Ion Microscopy.

Final rept.,
A. J. Melmed, and R. Klein. 1986, 4p
Pub. in Physical Review Letters 56, n14 p1478-1481 1986.

Keywords: *Aluminum alloys, *Manganese containing alloys, *Crystal symmetry, Reprints, *Quasicrystals, *Icosahedral phase, Field ion microscopy.

Long-range icosahedral orientational order in an Al-12 at. % Mn alloy phase is confirmed by direct observation in field ion microscopy. In addition, a considerable amount of local disorder and a large number of defects or anti-phase boundaries are found.

801,191

PB88-175609

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Crystal Structure Determination of BaNd2Ti3O10 Using High Resolution Electron Microscopy.

Final rept.,
A. Olsen, and R. S. Roth. 1985, 11p
Pub. in Jnl. of Solid State Chemistry 60, n3 p347-357 Dec 85.

Keywords: *Crystal structure, Electron diffraction, Electron microscopy, Monoclinic lattices, X-ray diffraction, Crystal lattices, Reprints, *Barium neodymium titanates, High resolution.

The crystal structure of BaNd2Ti3O10 has been determined by electron diffraction and high resolution electron microscopy. The unit cell is monoclinic with P2(1)/m as the most probable space group and not orthorhombic as previously found by X-ray diffraction. However, the structure has an orthorhombic pseudosymmetry, but due to the small Nd(3+) cations the octahe-

dra are tilted and the structure is monoclinic. The cell dimensions based on X-ray data are: a(m) = 7.7310 + or - 0.0006 Å; b(m) = 7.6661 + or - 0.0007 Å; c(m) = 14.210 + or - 0.002 Å; beta(m) = 97.82 + or - 0.01 deg.

801,192

PB88-176474

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Irregularity in Nb-Ti Filament Area and Electric Field Versus Current Characteristics.

Final rept.,
J. W. Ekin. 1987, 5p
Contract DE-A105-85ER40240
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD., and Department of Energy, Washington, DC.
Pub. in Cryogenics 27, p603-607 Nov 87.

Keywords: *Superconductors, Electric fields, Filaments, Reprints, Niobium titanium, Critical current.

There is a correlation between irregularity in filament area ('sausaging') and the shape of a superconductor's electric field (E) versus current (I) relationship. The shape of the E-I characteristic is quantified in terms of the resistive transition parameter, n, defined by E proportional to (I sup n). Low values of n less than about 20 correlate with a wide filament diameter distribution, while n values over 50 correspond to a distribution more than 2.5 times smaller. It is proposed that the low-field (constant) value of n be used as an index of filament quality in evaluating different superconductors for practical applications. A model is also suggested to explain the effect in terms of a locally depressed filament critical current, which forces current to transfer across the normal matrix material into neighboring filaments. The relationship between n and the statistical distribution of filament diameters may be useful as an easy method of estimating the extent of sausaging in practical multifilamentary Nb-Ti superconductors from measurements of n.

801,193

PB88-176516

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Local Atomic Environments in the Manganese-Aluminum Icosahedral Phase.

Final rept.,
G. G. Long, and M. Kuriyama. 1987, 12p
Pub. in Incommensurate Crystals, Liquid Crystals, and Quasi-Crystals, p337-348 1987.

Keywords: Aluminum alloys, Manganese alloys, *Icosahedral phase, *Aluminum manganese, *Quasicrystals.

The atomic scale structure of icosahedral phase MnAl was derived from experimental diffraction data. The resulting structure is compared to theoretical work and to other experimental data. A large array of the self-modulated structure, which is space-filling, was used for site topology studies.

801,194

PB88-176714

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Small Defects in Crystalline Polyethylene.

Final rept.,
D. H. Reneker, and J. Mazur. 1988, 11p
Pub. in Polymer 29, p3-13 Jan 88.

Keywords: *Crystal defect, *Dispiration, Disclination, Dislocation, Reprints, *Defect lines, Polymer crystal, Polymer conformations, Polyethylene, Chain twist boundary, Free volume.

A family of five crystallographic defects of three classes (two dislocations, two dispirations and one disclination) which primarily involve only one polymer chain is described for polyethylene. The extra energy associated with each defect in a perfect polyethylene crystal was computed. The crystal model used consisted of a central chain containing the defect with 18 zig-zag chains in two shells around the central chain. The zig-zag chains each had 60 carbon atoms. The conformation of each defect, placed near the center of the central chain, was adjusted to minimize the sum of the interatomic interactions. A closely related procedure was used to calculate the energy per chain at boundaries where each chain contains an identical 'partial' dislocation or disclination. The characterization of

these well defined defects and partial defects greatly simplifies the establishment of connections between atomic and macroscopic scale phenomena in crystalline polyethylene.

801,195
PB88-176748 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Evidence for Structural Disorder in the Icosahedral Phase.

Final rept.,
M. J. Kaufman, and A. J. Melmed. 1987, 6p
Pub. in Philosophical Magazine Letters 56, n4 p129-134 1987.

Keywords: *Aluminum alloys, *Manganese containing alloys, Electron diffraction, Crystal defects, Crystal structure, Reprints, *Quasicrystals, *Icosahedral phase, Transmission electron spectroscopy.

The authors report transmission electron microscopy results on quasicrystalline samples of Al-25wt% Mn and Al-38wt% Mn-5wt% Si melt-spun flakes. The selected-area diffraction patterns (SADPs) from 'off-axis' orientations show not only sharp diffraction maxima but also a diffuse ring, invariant of sample thickness, indicating that it does not arise from amorphous surface oxide. Over-exposed SADPs taken from axial orientations also showed the weak diffuse ring. The authors results indicate the presence of disordered material within the icosahedral phase. Models for the icosahedral phase which involve an assembly of icosahedral clusters inherently contain interstitial voids, which may contain disordered material. Thus their results support these models rather than those derived from space-filling tilings, or multiple twinning.

801,196
PB88-176888 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Advances in Microscopy: Scanning Tunneling and Electron Polarization Microscopy.

Final rept.,
R. J. Celotta. 1988, 13p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in Applied Surface Science 31, p59-71 1988.

Keywords: *Electron microscopy, *Surfaces, Polarization(Spin alignment), Reprints, Scanning electron microscopy, Scanning tunneling microscopy, Electron spin polarization, Surface magnetism.

An overview is presented of two new techniques that can be used to study the physical, electronic, and/or magnetic microstructure of surfaces. The method of scanning tunneling microscopy has emerged as a powerful way of observing physical structure down to the atomic level and is being extended to give further insight into surface electronic structure over atomic dimensions as well. Scanning electron microscopy with polarization analysis is being applied to the study of magnetic microstructures with sizes down to 10 nm and is capable of demonstrating the effect that physical microstructure has on magnetic domains. Discussions of both techniques will include descriptions of the method, the apparatus used, and some examples of current applications.

801,197
PB88-177621 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Extinction Theory in X-ray Topography.

Final rept.,
M. Kuriyama, and G. G. Long. 1984, 13p
Pub. in Applications of X-ray Topographic Methods to Materials Science, p97-109 1984.

Keywords: *X ray diffraction, *X ray topography.

An x-ray topograph is an enlarged view of a Laue diffraction spot, taken in either the transmission or the surface reflection geometry. Laue spots display fine structure whenever the sample crystal is not ideally perfect. The fine structure is directly related to the microstructure of the sample crystal, but because different geometrical projections, diffraction conditions, and x-ray energies are used for different spots, the fine structure observed is not necessarily the same for different spots arising from the same sample. The varying fine structure as a function of energy illustrates the underlying nature of x-ray topography--the x-ray extinction effect. The reduction in primary and secondary extinction due to the degree of crystal perfection is re-

sponsible for the topographic fine structure that is observed. These extinction phenomena appear in different ways due to diffraction or scattering in different local regions in a crystal, creating image contrast within diffraction spots.

801,198
PB88-177639 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Diffraction Imaging of High Quality Bismuth Silicon Oxide with Monochromatic Synchrotron Radiation: Implications for Crystal Growth.

Final rept.,
B. Steiner, U. Laor, M. Kuriyama, G. G. Long, and R. Dobbryn. 1988, 22p
Pub. in Jnl. of Crystal Growth 87, p79-100 1988.

Keywords: *Crystal growth, X ray diffraction, Synchrotron radiation, Monochromatic radiation, Reprints, *Bismuth silicon oxide, X ray topography.

Three slices from a high quality boule of bismuth silicon oxide have been examined by X-ray diffraction imaging (topography) with monochromatic synchrotron radiation. The absence of macroscopic inhomogeneous strains, which are usually found in large single crystals, permits us to observe several types of microscopic strain pattern in the form of growth striations and interface boundaries. Each is associated with distinct aspects of the crystal growth. Analysis of the strains leads to a detailed understanding of the formation of a high quality bismuth silicon oxide boule. The model developed suggests ways to realize further improvement in crystal perfection.

801,199
PB88-177647 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Asymmetric Crystal Topography with X-ray Image Magnification.

Final rept.,
M. Kuriyama, and W. J. Boettinger. 1984, 9p
Pub. in Applications of X-ray Topographic Methods to Materials Science, p23-31 1984.

Keywords: *Crystal structure, *X ray diffraction, Crystal defects, Synchrotron radiation, Monochromatic radiation, *X ray topography.

Crystalline imperfections are imaged in x-ray topographs by diffraction contrast, which is created by primary and secondary extinction effects. In traditional x-ray scattering physics, these effects are thought to be caused by generalized line broadening due to deviations from ideal periodicity in crystals. Unlike ordinary line broadening, where a scattering vector is the only variable to describe a given diffracting condition, the generalized concept of line broadening requires two wave vectors as independent variables to describe the directions of the incident beam and the scattered beams. For the quantitative characterization of microstructures a highly localized and extremely well-collimated beam is required to define the x-ray 'in-state' with respect to a sample crystal. Also required is a capability for the detection of small local differences in scattered of diffracted beams as the 'out-states'. A few years ago, the authors developed an x-ray optical configuration suitable for defining both the in-state and the out-states. In the paper, the authors describe the system and the development of a second generation image detector for advanced quantitative microstructure characterization.

801,200
PB88-178470 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Nuclear Magnetic Resonance in Al-Rich Quasiperiodic Crystals.

Final rept.,
M. Rubinstein, G. H. Stauss, T. E. Phillips, K. Moorjani, and L. H. Bennett. 1986, 4p
Pub. in Jnl. of Mater. Res. 1, n2 p243-246 Mar/Apr 86.

Keywords: *Nuclear magnetic resonance, *Aluminum alloys, *Manganese containing alloys, Comparison, Reprints, *Quasicrystals, *Icosahedral phase, Aluminum intermetallics, Manganese intermetallics, Decagonal phase, Knight shift, Aluminum 27, Manganese 55.

The (27)Al and the (55)Mn nuclear magnetic resonance powder pattern lineshapes have been obtained in icosahedral and decagonal (T phase) Al-Mn quasi-

periodic crystals, and are compared to that of orthorhombic Al(6)Mn. The quasiperiodic crystals yield much broader spectra with little resolved structure. The quadrupole and Knight shift parameters for the (55)Mn resonance in orthorhombic Al(6)Mn have been determined as (absolute value of nu sub Q) = 0.76 MHz, K(ax) = -0.00027, K(iso) = +0.005. The results imply that Al(6)Mn and the quasiperiodic crystals have similar electronic and magnetic properties.

801,201
PB88-178538 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.

Cusp Singularity in Surfaces That Minimize an Anisotropic Surface Energy.

Final rept.,
J. E. Taylor, and J. W. Cahn. 1986, 4p
Pub. in Science 233, n4763 p548-551 1986.

Keywords: *Crystal growth, *Surfaces, Surface energy, Free energy, Anisotropy, Reprints, *Minimal surfaces, Singularity.

A mathematical proof shows that a surface with a cusp-shaped singularity can arise from minimizing an anisotropic surface free energy for a portion of a crystal surface. Such cusps have been seen on crystal surfaces but usually have been interpreted as being the result of defects or nonequilibrium crystal growth. The result predicts that they can occur as equilibrium or near-equilibrium phenomena. It also enriches the mathematical theory of minimal surfaces.

801,202
PB88-187471 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

EXAFS Measurements of Ion-Implanted Amorphous Surface Layers.

Final rept.,
C. E. Bouldin, R. A. Forman, M. I. Bell, E. P. Donovan, and G. K. Hubler. 1986, 6p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers)--X-rays in Materials Analysis: Novel Applications and Recent Developments, San Diego, CA., August 21-22, 1986, v690 p43-48.

Keywords: *Germanium, Radiation damage, Annealing, Amorphous materials, Ion implantation.

EXAFS measurements of ion-damaged amorphous germanium (a-Ge) show that low temperature annealing causes a structural relaxation in the as-implanted a-Ge. It is found that there is a sharpening of the first shell in the radial distribution but no change occurs in the first-shell distance or coordination number. No higher shells in the radial distribution are observed, either before or after annealing, indicating that these shells remain highly disordered. The observed structural relaxation is an amorphous-amorphous transition; no nucleation of microcrystals takes place. EXAFS measurements are made using conversion electron detection (CEEXAFS), which is essentially total electron yield detection in ambient conditions, allowing the EXAFS measurements to be near-surface sensitive with a sampling depth of 600 to 800 Å.

801,203
PB88-187489 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Strain Patterns in Gallium Arsenide Wafers: Origins and Effects.

Final rept.,
R. A. Forman, J. R. Hill, M. I. Bell, G. S. White, S. W. Freiman, and W. Ford. 1987, 9p
Pub. in Defect Recognition and Image Processing in III-V Compounds II, p63-71 1987.

Keywords: *Gallium arsenides, *Fracture properties, *Strains, Patterns, Wafers, Inclusions, X ray topography.

Using the rapid x-ray topographic system described earlier, (in DRIP I), the authors have examined a large number of LEC GaAs wafers, both commercial and research, and have been able to identify the sources of some of the observed patterns. They have also studied the effects of the inhomogeneous strain on the fracture properties of the wafers. The high gradients of strain cause deviations from expected crack growth behavior in fracture tests. These deviations include crack velocity variations and crack tip deflections. The grown-in defects cause point-to-point variations in

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hardness and toughness values for the material. Sequential wafers exhibit closely related topographs and similar fracture properties. Inclusions have been identified in indium-doped wafers and produce a characteristic topographic pattern when the inclusion lies in the wafer under study.

801,204

PB88-187497

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Free Carrier Absorption and Interstitial Oxygen Measurements.

Final rept.,

W. K. Gladden, and A. Baghdadi. 1987, 12p

Pub. in *Emerging Semiconductor Technology*, ASTM (American Society for Testing and Materials) Special Technical Publication 960, p353-364 1987.

Keywords: *Silicon, Charge carriers, Oxygen, Interstitials, Reprints, *Infrared absorption, Fourier transform spectroscopy.

The infrared (IR) absorption of n- and p-type silicon samples was measured over the concentration range about 10 to the 15th power to 6 x 10 to the 17th power atoms/wavenumber. The data were fit to a logarithmic function with this dependence, and these results were applied to the determination of the baseline from which to compute the corrected net IR absorption at 1107/cm due to interstitial oxygen. Application of the correction for the free carrier absorption results in an improvement of 3% to 30% in the accuracy of the oxygen content determination at dopant concentrations above 10 to the 16th power atoms/cc3.

801,205

PB88-188537

Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Evidence for Weak Link and Anisotropy Limitations on the Transport Critical Current in Bulk Polycrystalline Y1Ba2Cu3Ox.

Final rept.,

J. W. Ekin, A. I. Braginski, A. J. Panson, M. A.

Janocko, D. W. Capone, N. J. Zaluzec, B.

Flandermeier, O. F. de Lima, M. Hong, J. Kwo, and

S. H. Liou. 1987, 8p

Contract DE-AL01-84ER52113

Sponsored by Department of Energy, Washington, DC. Pub. in *Jnl. of Applied Physics* 62, n12 p4821-4828, 15 Dec 87.

Keywords: *Superconductors, Grain boundaries, Anisotropy, Reprints, *High temperature superconductors, *Barium copper yttrium oxides, *Yttrium barium cuprates, *Critical current.

Measurements of the transport critical-current density ($J_{sub c}$), magnetization $J_{sub c}$, and magnetoresistance in a number of bulk sintered samples of Y1Ba2Cu3Ox from several different laboratories indicate that the transport $J_{sub c}$ is limited by weak-link regions between high $J_{sub c}$ regions. The weak-link $J_{sub c}$ has a Josephson character, decreasing by two orders of magnitude as the magnetic field is increased from 0.1 to 10 mT at 77K. An examination of the grain-boundary region in Y1Ba2Cu3Ox shows no observable impurities or second phases to the scale of the (001) lattice planes (about 12A). The effect of intrinsic conduction anisotropy is discussed. A current-transfer model is proposed in which weak conduction along the c axis plays a role in limiting $J_{sub c}$ at grain boundaries. Orienting the grains in the powder state during processing may result in enhanced transport $J_{sub c}$ in bulk conductors.

801,206

PB88-189154

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Possible Evidence for Superconducting Layers in Single Crystal YBa2Cu3O(7-x) by Field Ion Microscopy.

Final rept.,

A. J. Melmed, R. D. Shull, C. K. Chiang, and H. A.

Fowler. 1988, 3p

Pub. in *Science* 239, p176-178, 8 Jan 88.

Keywords: *Superconductors, Single crystals, Reprints, *High temperature superconductors, *Barium copper yttrium oxides, *Yttrium barium cuprates, Field ion microscopy.

The high-transition-temperature superconducting ceramic material YBa2Cu3O(7-x) ($0 < x < 0.5$) has been

examined by field ion microscopy. Specimens from nominally superconducting and nonsuperconducting samples (determined by magnetic susceptibility measurements) were studied by field ion microscopy and significant differences were found. Preferential imaging of atomic or molecular layers, due to preferential field evaporation, field ionization, or both, was found in the superconducting phase below the transition temperature and is interpreted as possible evidence for the occurrence of relatively highly conducting layers in the YBa2Cu3O(7-x) unit cell perpendicular to the orthorhombic c-axis. Similar results were obtained for YbBa2Cu3O(7-x).

801,207

PB88-189295

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Effects of Random Field Interactions in Amorphous Rare Earth Alloys.

Final rept.,

J. J. Rhyne. 1985, 6p

Pub. in *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics* MAG-21, n5 p1990-1995 Sep 85.

Keywords: *Rare earth alloys, *Ferrimagnetic materials, Iron alloys, Neutron scattering, Reprints, Spin glass state, Amorphous materials, Small angle scattering.

Recent neutron small angle scattering studies have shown that amorphous alloys of non S-state rare earth elements with Fe are not ferrimagnetic as inferred from magnetization data, but rather exhibit a spin-glass type of order. The data show no divergence in the spin correlation length below $T(c)$, and the gradual evolution of the scattering lineshape from Lorentzian to a Lorentzian plus Lorentzian squared form appropriate for a system in which random fields destroy the long range order. SANS data taken in applied fields indicate the formation of an infinite cluster in low fields which is responsible for the ferrimagnetic magnetization response and which co-exists with increasingly smaller residual clusters.

801,208

PB88-189303

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Magnetic Fluctuations and Two-Dimensional Ordering in ErBa2Cu3O7.

Final rept.,

J. W. Lynn, W. H. Li, Q. Li, H. C. Ku, H. D. Yang, and

R. N. Shelton. 1987, 4p

Pub. in *Physical Review B* 36, n4 p2374-2377, 1 Aug 87.

Keywords: *Superconductors, Neutron diffraction, Magnetic properties, Reprints, *High temperature superconductors, *Barium copper erbium oxides, *Erbium barium cuprates, *Magnetic superconductors, Small angle scattering.

Neutron-diffraction and small-angle scattering techniques have been used to study the magnetic properties of ErBa2Cu3O7. Below the superconducting transition of 95 K there is a decrease in the small-angle scattering, which has the correct amplitude, temperature dependence, and q dependence to be interpreted as the screening of the paramagnetic fluctuations by the superconducting electrons. At low temperatures (about 1/2 K), the Er moments become ordered two dimensionally, with chains of spins coupled ferromagnetically, while adjacent chains align antiparallel.

801,209

PB88-189568

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Monte Carlo Study of Growth in the Two-Dimensional Spin-Exchange Kinetic Ising Model.

Final rept.,

J. G. Amar, F. E. Sullivan, and R. D. Mountain. 1988,

13p

Pub. in *Physical Review B* 37, n1 p196-208, 1 Jan 88.

Keywords: Monte Carlo method, Reprints, *Ising model, Spinodal decomposition, Two dimensional.

Results obtained from extensive Monte Carlo simulations of domain growth in the two-dimensional spin-exchange kinetic Ising model, with equal numbers of up and down spins, are presented. Using different measures of domain size - including the pair-correlation function, the energy, and circularly-averaged structure

factor - the domain size is determined (at $T = 0.5T(c)$) as a function of time for times up to one million Monte Carlo steps. In addition, the scaling of the structure factor and anisotropy effects due to the lattice are examined.

801,210

PB88-192166

Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Elastic Constants and Debye Temperature of Polycrystalline Y1Ba2Cu3O(7-x).

Final rept.,

H. M. Ledbetter, M. W. Austin, S. A. Kim, and M. Lei.

1987, 4p

Pub. in *Jnl. of Mater. Res.* 2, n6 p786-789 Nov/Dec 87.

Keywords: *Superconductors, Modulus of elasticity, Shear modulus, Perovskites, Bulk modulus, Elastic properties, Poisson ratio, Ultrasonic radiation, Reprints, *High temperature superconductors, *Yttrium barium cuprates, *Barium copper yttrium oxides, Debye temperature.

Using ultrasonic methods, the quasi-isotropic elastic stiffnesses of void-containing Y1Ba2Cu3O(7-x) were determined. By a composite-material model, these were corrected to the void-free state. From these, the Debye characteristic temperature was calculated. All the elastic stiffnesses fall well below those of polycrystalline BaTiO3, an approximate crystal-structural building block of Y1Ba2Cu3O(7-x). The low apparent stiffness may result from oxygen vacancies, which soften interionic forces. Also, it may result from microcracks, which reduce elastic stiffness without lowering mass density.

801,211

PB88-192174

Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Elastic Properties of Metal-Oxide Superconductors.

Final rept.,

H. M. Ledbetter. 1988, 7p

Pub. in *Jnl. of Metals* 40, n1 p24-30 Jan 88.

Keywords: *Superconductors, Elastic properties, Crystal structure, Phonons, Specific heat, Ultrasonic radiation, Thermal expansion, Twinning, Reprints, *High temperature superconductors, *Yttrium barium cuprates, *Barium copper yttrium oxides, Atomic radii.

The article reviews the elastic properties of the new perovskite-related superconductors, especially Y1Ba2Cu3O(7-x). Considered are such related matters as atomic size, crystal structure, microstructure, twins, and microscopic mechanism. Also examined are related physical properties such as Debye characteristic temperature, thermal expansivity, specific heat, ultrasonic attenuation, and phonon density-of-states.

801,212

PB88-192208

Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Shear-Modulus Change Below $T(c)$ in YBa2Cu3O(7-x).

Final rept.,

H. M. Ledbetter, M. W. Austin, S. A. Kim, T. Datta,

and C. E. Violet. 1987, 3p

Pub. in *Jnl. of Mater. Res.* 2, n6 p790-792 Nov/Dec 87.

Keywords: *Superconductors, *Shear modulus, Elastic properties, Acoustic velocity, Ultrasonic radiation, Reprints, *High temperature superconductors, *Yttrium barium cuprates, *Barium copper yttrium oxides.

The ultrasonic transverse-wave velocity in the high- $T(c)$ metal-oxide superconductor YBa2Cu3O(7-x) between 275 and 4 K was measured. Above $T(c)$ the velocity shows normal behavior: during cooling, it displays a monotonic increase with decreasing slope. During cooling below $T(c)$ the shear modulus departs from normal behavior. These results depart dramatically from those expected for a simple second-order normal-superconducting phase transition.

801,213

PB88-194097

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.

High Resolution Electron Microscopy of Aluminum-Based Icosahedral Quasi-Crystals.

Final rept.,
R. Portier, D. Shechtman, D. Gratias, J. Bigot, and J. W. Cahn. 1986, 4p
See also PB88-175419.

Pub. in Proceedings of Institute of Physics Electron Microscopy and Analysis Group Conference, Newcastle-upon-Tyne, England, September 2-5, 1985, p317-320 1986.

Keywords: *Aluminum manganese alloys, Electron microscopy, *Quasicrystals, *Icosahedral phase, High resolution.

The recently discovered quasi-crystals can be described by the Cut and Projection Method (C.P.M.) which is a generalized discrete version of the earlier hyperspace description used for continuous density functions of incommensurate structures. The particular topological properties of such aperiodic networks are best observed by direct imaging of the quasi-lattice in the electron microscope. It is shown here that the relevant characteristics of quasi-periodicity are present in the images which can be interpreted independently from the actual organization of the atomic species. The observations reported here were made on rapidly solidified ribbons of the Al₆Mn alloy. Electron microscopy was performed. Numerous homogeneously distributed pentagons and decagons are observed at atomic scale, which fits remarkably well with the simple projection of the quasi-lattice generated by C.P.M.

801,214

PB88-194212 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Magnetic Field Dependence of the Small Angle Scattering in Amorphous DyCu.

Final rept.,
S. J. Pickart, S. Hasanain, D. Andrauskas, H. A. Alperin, M. Spano, and J. J. Rhyne. 1985, 2p
Pub. in Jnl. of Applied Physics 57, n8 p3430-3431, 15 Apr 85.

Keywords: *Copper alloys, Magnetic fields, Reprints, *Dysprosium alloys, Small angle scattering, Spin glass state, Amorphous materials, Magnetism.

The previously reported small angle neutron scattering (SANS) from the spin glass amorphous DyCu (T_f = 17K) was examined in applied fields up to 15 koe. Field-cooling and relaxation effects were also observed in the SANS intensity and are compared with similar phenomena in magnetization measurements.

801,215

PB88-194220 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Quenching of Long-Range Magnetic Order by Random Interactions in Amorphous Alloys.

Final rept.,
J. J. Rhyne. 1986, 6p
Pub. in Physica B: Physics of Condensed Matter and C: Atomic, Molecular and Plasma Physics, Optics 136, n1-3 p30-35 Jan/Feb 86.

Keywords: *Iron alloys, *Terbium alloys, Zirconium containing alloys, Neutron scattering, Rare earth alloys, *Magnetic ordering, Small angle scattering, Amorphous materials, Magnetism.

Small angle neutron scattering data on magnetically concentrated amorphous alloys have shown that the occurrence of ferromagnetic order can be suppressed by random exchange and anisotropy interactions. Two different regimes are discussed for which long range magnetism is destroyed by random interactions: (1) alloys with large iron concentration such as Fe(91)Zr(9) and Fe(98)Tb(2) which show evidence of competing ferromagnetic and antiferromagnetic interactions which truncate the divergence of the spin correlation length, xi. In the second class (2) are alloys for which large single-ion random anisotropy interactions destroy long range order as found in Tb(75)Fe(25) and TbFe(2).

801,216

PB88-194238 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Magnetic Properties of Amorphous Metals.

Final rept.,
J. J. Rhyne. 1985, 18p
Pub. in Jnl. of Non-Crystalline Solids 76, n1 p129-146 Nov 85.

Keywords: *Ferromagnetic materials, Iron alloys, Neutron scattering, Nickel alloys, Invar, Reprints, Amorphous materials, Spin glass state, Boron alloys, Spin waves, Magnetism.

Neutron scattering has provided unique information about the nature of magnetism in amorphous alloys. The paper reviews some of the results principally obtained on two ribbon form metallic glass systems -- (Fe(x) Ni(1-x))₇₅P₁₆B₅Al₃ and Fe(x)B(1-x). The former exhibits three states depending on composition: pure ferromagnetism; reentrant spin glass; and, ordinary spin glass. The neutron results provide evidence for the coexistence of spin glass and ferromagnetic correlations in the intermediate regime. The alloys of Fe and B show INVAR phenomena which result in anomalously small values of the effective spin wave stiffness calculated from low temperature magnetization and Mossbauer data.

801,217

PB88-194246 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Neutron Scattering Study of the Spin Dynamics of Amorphous Fe(70)Ni(20)Zr(10).

Final rept.,
J. A. Fernandez-Baca, J. J. Rhyne, and G. E. Fish. 1986, 2p
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, pt1 p289-290 Feb 86.

Keywords: Iron alloys, Nickel containing alloys, Zirconium containing alloys, Invar, Neutron scattering, Magnons, Reprints, *Spin waves, Amorphous materials, Magnetism.

Neutron inelastic scattering measurements have been performed on amorphous Fe(70)Ni(20)Zr(10). Spin waves were observed in the wave vector range 0.07/Å = or < q = or < 0.12/Å at temperatures 0.55 T sub c = or < T = or < 0.89 T sub c.

801,218

PB88-194253 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Static and Dynamic Spin Correlations and Exchange Interactions in Cd(1-x)Mn(x)Te.

Final rept.,
T. M. Giebultowicz, J. J. Rhyne, W. Y. Ching, D. L. Huber, and R. R. Galazka. 1986, 2p
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, pt3 p1149-1150 Feb 86.

Keywords: Neutron scattering, Computerized simulation, Anisotropy, Reprints, *Cadmium manganese tellurides, Magnetic semiconductors, Exchange interactions, Spin glass state.

Static and dynamic spin correlations in Cd(0.35)Mn(0.65)Te were studied by neutron scattering and by computer simulation. It is shown that it is possible to determine the exchange constant for the nearest neighbors (J sub NN) on the basis of inelastic scattering data, and for the next-nearest neighbors (J sub NNN) by measuring the anisotropy of the range of static correlations.

801,219

PB88-194428 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Method for Making Low-Resistivity Contacts to High Tc Superconductors.

Final rept.,
J. W. Ekin, A. J. Panson, and B. Blankenship. 1988, 3p
See also PB88-167960. Sponsored by Department of Energy, Washington, DC.
Pub. in Applied Physics Letters 52, n4 p331-333, 25 Jan 88.

Keywords: *Superconductors, *Electric contacts, Electrical resistivity, Reprints, *High temperature superconductors, Yttrium barium cuprates, Barium copper yttrium oxides.

A method for making low-resistivity contacts to high Tc superconductors has been developed, which has

achieved contact surface resistivities less than 10 microhms sq cm at 76 K and does not require sample heating above about 150 deg C. This is an upper limit for the contact resistivity obtained at high current densities up to 100 - 1000 A/sq cm across the contact interface. At lower measuring current densities the contact resistivities were lower and the voltage-current curve was nonlinear, having a superconducting transition character.

801,220

PB88-198882 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Glass and Phase Transitions in (KBr)(sub 1-x)(KCN)(sub x).

Final rept.,
A. Loidl, K. Knorr, J. M. Rowe, and G. J. McIntyre. 1988, 10p
Pub. in Physical Review B 37, n1 p389-398, 1 Jan 88.

Keywords: *Potassium bromide, *Potassium cyanides, *Phase transformations, Single crystals, Neutron diffraction, Crystal structure, Reprints, Mixed crystals.

Results of a single-crystal neutron-diffraction study of the mixed molecular system (KBr)(1-x)(KCN)(x) are presented. The crystal with a CN(1-) concentration x=0.65 exhibits a ferro-elastic transition from a plastic high-temperature phase of cubic symmetry to a low-temperature rhombohedral phase. The crystals with concentrations x=0.53 and 0.57 undergo transitions into a quadrupolar glass state. In all the crystals investigated, the diffraction profiles near the transition temperatures are dominated by diffuse-scattering contributions. These diffuse intensities are due to random strains which are generated by the substitutional Br(1-) atoms acting as static impurity centers. The results demonstrate the importance of random strains for the order of the low-temperature state.

801,221

PB88-198908 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Soft-X-ray Absorption and Emission Spectra and the Electronic Structure of the Ba₂YCu₃O(7-x) Superconductor.

Final rept.,
K. L. Tsang, C. H. Zhang, T. A. Callcott, L. R. Canfield, D. L. Ederer, J. E. Blendell, C. W. Clark, N. Wassdahl, J. E. Rubensson, G. Bray, N. Mortenson, J. Nordgren, R. Nyholm, and S. Cramm. 1988, 4p
See also DE88-002609. Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Physical Review B 37, n4 p2293-2296, 1 Feb 88.

Keywords: *Superconductors, X ray fluorescence, Synchrotron radiation, Reprints, *High temperature superconductors, *Yttrium barium cuprates, *Barium copper yttrium oxides, Density of states, Soft x radiation, Photoelectron spectroscopy.

The authors present e-beam-excited soft-x-ray emission spectra and total-photoelectron-yield spectra in the 20-600 eV photon energy range for Ba₂YCu₃O(7-x). In soft-x-ray emission, the N(4,5) structure of Ba, the M(4,5) spectrum of Y, and the K spectrum of O provide a direct measure of the p-type partial density of states (p-PDOS) localized on the respective atomic sites. In each case the p-PDOS is very small at the Fermi energy.

801,222

PB88-199062 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Physics for Models of Gallium Arsenide Devices.

Final rept.,
H. S. Bennett, and J. R. Lowney. 1987, 6p
Pub. in Proceedings of International Workshop on the Numerical Modelling of Semiconductors (1st), Los Angeles, CA., December 11-12, 1986, p31-36 1988.

Keywords: *Semiconductor devices, *Gallium arsenides, Semiconductor doping, Charge carriers, Energy bands, Mathematical models, Density of states, Band theory.

Numerically simulating the behavior of GaAs devices requires a model for the distorted densities of states, band edge shifts, Delta E sub c and Delta E sub v, and effective intrinsic carrier concentrations, n. The subscripts c and v denote the conduction and valence

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bands, respectively. Klauder's self-energy methods (third-level and fifth-level) are applied to calculate the effects of carrier-dopant ion interactions on the densities of states for GaAs. The effects of carrier-carrier interactions have been calculated according to the theory of Abram et al. modified for 300 K. These calculations span most of the range of densities encountered in GaAs devices. The authors present in the paper theoretical data on how $\Delta E_{\text{sub } c}$, $\Delta E_{\text{sub } v}$, and n vary with dopant densities. The variations with dopant and/or carrier densities of the distorted densities of states, Fermi energies screening radii, and first Born shifts will be given in a future publication.

801,223

PB88-199070

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Anomalous Behavior of Tunneling Contacts in Superconducting Perovskite Structures.

Final rept.,

J. Moreland, L. F. Goodrich, J. W. Ekin, T. E.

Capobianco, and A. F. Clark. 1988, 8p

Grant N00014-86-F-0109, Contract DE-AI01-

84ER52113

Sponsored by Office of Naval Research, Washington, DC., and Department of Energy, Washington, DC.

Pub. in *Advances in Cryogenic Engineering Materials*, v34 p625-632 1988.

Keywords: *Superconductors, Energy gap, Abnormalities, *High temperature superconductors, *Electron tunneling spectroscopy, *Yttrium barium cuprates, *Lanthanum strontium cuprates, *Barium copper yttrium oxides, *Copper lanthanum strontium oxides.

The authors' break junction results for electron tunneling spectroscopy of the perovskite superconductors La-Sr-Cu-O and Y-Ba-Cu-O are similar to those obtained using thin film, scanning tunneling microscopy, and point contact methods. Energy gap structures are sometimes observed in the measured current voltage characteristics. More often, however, the characteristics are anomalous when compared to previous tunneling studies of BCS superconductors. The anomalies include linearly increasing conductance with voltage, large deviations in junction conductance above the gap edge, and junction diode action. The authors discuss some possible explanations for these observations.

801,224

PB88-199088

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Current-Ripple Effect on Superconductive DC Critical Current Measurements.

Final rept.,

L. F. Goodrich, S. L. Bray, and A. F. Clark. 1988, 8p

Pub. in *Advances in Cryogenic Engineering Materials*, v34 p1019-1026 1988.

Keywords: *Superconductors, Alternating current, Direct current, Power supplies, Voltmeters, Reprints, *Niobium titanium, *Critical current, Ripples.

The effect of sample-current power-supply ripple on the measurement of dc critical current is reported. Measurements were made on multifilamentary NbTi superconductor. In general, ripple in a current supply becomes more significant above 500 A because effective filtering is difficult. The presence of current ripple reduces the measured dc critical current. Ripple also causes noise at the input to the voltmeter used for the measurements. The quantitative effect of current ripple was studied using a battery current supply modified to allow the creation of ripple current with variable frequency and amplitude. Problems common to all large-conductor critical-current measurements are discussed.

801,225

PB88-199096

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Magnetic Susceptibility of Sintered and Powdered Y-Ba-Cu-O.

Final rept.,

D. X. Chen, R. B. Goldfarb, J. Nogues, and K. V.

Rao. 1988, 3p

Pub. in *Jnl. of Applied Physics* 63, n3 p980-982, 1 Feb 88.

Keywords: *Superconductors, Reprints, *High temperature superconductors, *Yttrium barium cuprates,

*Barium copper yttrium oxides, AC losses, Magnetic susceptibility, Temperature dependence.

The real and imaginary parts of ac susceptibility of a sintered Y1Ba2Cu3O (7-delta), superconductor were measured before and after powdering. The temperature-dependent susceptibility may be separated into two contributions, one sensitive and the other relatively insensitive to the magnitude of the measuring field. The former is partially suppressed by coarsely crushing the sample. It is completely suppressed after finely powdering, whereupon the susceptibility curves become insensitive to the magnitude of the measuring field. Several models apparently consistent with the results are discussed.

801,226

PB88-204433

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Electron Tunneling Measurements in LaSrCuO and YBaCuO.

Final rept.,

J. Moreland, J. W. Ekin, L. F. Goodrich, T. E.

Capobianco, and A. F. Clark. 1987, 3p

Contracts DE-AI01-84ER52113, N00014-86-F-0109

Sponsored by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.

Pub. in *Proceedings of Spring Meeting of the Materials Research Society*, Anaheim, CA., April 23-24, 1987, p273-275.

Keywords: *Electron tunneling, *Superconductors, Measurement, *High temperature superconductors, *Yttrium barium cuprates, *Lanthanum strontium cuprates, *Barium copper yttrium oxides, *Copper lanthanum strontium oxides.

The break junction technique, whereby vacuum tunneling occurs within the fracture of a bulk sample is used to study the LaSrCuO and YBaCuO perovskite superconductors. Structure in the current-versus-voltage characteristics is reminiscent of previous quasiparticle curves obtained for BCS superconducting materials. Some curves have anomalous qualities, including large dips in the junction conductance with increasing voltage just above a well defined tunneling gap edge, linearly increasing junction conductance with applied bias, features occurring near 1, 3, 5 voltage intervals.

801,227

PB88-204474

Not available NTIS

National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Reentrant Softening in Copper-Oxide Superconductors.

Final rept.,

C. E. Violet, T. Datta, H. M. Ledbetter, C. Almasan, and J. Estrada. 1988, 4p

Pub. in *Proceedings of Materials Research Society Symposium on High-Temperature Superconductors*, Boston, MA., November 30-December 4, 1988, v99 p375-378.

Keywords: *Superconductors, Acoustic velocity, Elastic properties, Poisson ratio, *High temperature superconductors, *Yttrium barium cuprates, *Lanthanum strontium cuprates, *Barium copper yttrium oxides, *Copper lanthanum strontium oxides.

On the basis of the authors reentrant-softening model, sound-velocity results in La(1.85)Sr(0.15)CuO4 and YBa2Cu3O(7-x) are shown to be neither dissimilar nor inconsistent with thermodynamic requirements. In both materials, as temperature decreases, the lattice softens just above T(c). Below T(c), this softening is offset by increased stiffness associated with the developing superconducting phase. The model agrees with results from other physical-property measurements, and it predicts that elastic stiffness is higher in the normal state than in the superconducting state.

801,228

PB88-213616

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Effects of Crystal Field and Exchange Interactions on the Spin Excitations in Rare Earth Laves-Phase Compounds.

Final rept.,

J. J. Rhyne, and N. C. Koon. 1986, 8p

Supersedes PB87-122545.

Pub. in *Proceedings of International Conference on Magn. Rare-Earths Actinides*, v1 p9-16 1983.

Keywords: *Rare earth compounds, *Magnons, Cobalt inorganic compounds, Iron inorganic compounds, Alu-

minum inorganic compounds, Neutron scattering, *Spin waves, Laves phases, Crystal field, Exchange interactions, Magnetism.

Inelastic neutron scattering techniques have been used to probe the spin excitations of a series of Laves-phase compounds RT2 of rare earths (R) with Fe, Co, and Al (T). In these compounds, the dispersion of the various magnetic modes provides information on the rare earth crystal field interactions, and on the exchange couplings between (1) T elements (T-T), (2) T and R elements (T-R), or (3) between the R elements alone (R-R).

801,229

PB88-215439

PC A05/MF A01

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Development of Standards for Superconductors, Interim Report January 1986-December 1987,

L. F. Goodrich. Feb 88, 85p NBSIR-88/3088

Contract DE-AI01-76PR06010

See also PB87-208559. Sponsored by Department of Energy, Washington, DC.

Keywords: *Superconductors, *Standards, Intermetallics, Measurement, Stability, *Critical current, Standard reference materials, Niobium tin, Niobium titanium, Aspect ratio.

A cooperative program with the Department of Energy, the National Bureau of Standards, other national laboratories, and private industry is in progress to develop standard measurement practices for use in large scale applications of superconductivity. The report describes research for the period January 1986 through December 1987. It contains the results of critical current studies on the effect of power-supply current ripple, measurements on cable strands, an interlaboratory comparison (round robin) on a large NbTi monolithic conductor, and a Nb3Sn round robin. Several useful current supply circuits have been developed. The reduction in coupling losses in multifilamentary NbTi conductors has been addressed by a study of the magnetic properties of matrix material consisting of dilute alloys of Mn in Cu. In addition, vibrating-sample magnetometry is shown to be adaptable to the measurement of coupling losses, in addition to hysteresis losses, in multifilamentary conductors.

801,230

PB88-217633

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Growth and Characterization of Cd(1-x)Zn(x)Te and Hg(1-y)Zn(y)Te.

Final rept.,

J. J. Kennedy, P. M. Amirtharaj, P. R. Boyd, S. B.

Qadri, and R. C. Dobbyn. 1988, 7p

Pub. in *Jnl. of Crystal Growth* 86, p93-99 1988.

Keywords: *Single crystals, X ray diffraction, Infrared detectors, Reprints, *Cadmium zinc tellurides, *Mercury zinc tellurides, *Bridgman method, Semiconductors, X ray topography, Photoreflectance.

The authors describe the modified vertical Bridgman conditions required for bulk growth of Cd(1-x)Zn(x)Te and Hg(0.87)Zn(0.13)Te. Good quality single crystals were obtained, with dislocation densities of approximately 40,000 to 100,000/sq cm. No precipitates were observed under IR microscopic examination. The Hg(0.8)Zn(0.13)Te crystal exhibited n-type behavior after a 250 C mercury saturated post-anneal, with a carrier density of 8×10^{15} to the 15th power/cc and mobility of 150,000 cm sq/V-s at 77 K. X-ray lattice constant measurements and atomic absorption analysis were used to establish accurately the zinc mole fraction in the crystals. The structural properties were studied using X-ray diffraction and topography; photoreflectance, a contactless form of the electric field modulated reflectivity technique, was used for optical characterization.

801,231

PB88-217823

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.

Triple-Shell Symmetry in alpha-(Al,Si)-Mn.

Final rept.,

H. A. Fowler, B. Mozer, and J. Sims. 1988, 8p

Pub. in *Physical Review B* 37, n8 p3906-3913, 15 Mar 88.

Keywords: *Aluminum manganese alloys, *Crystal structure, Neutron diffraction, Graphic methods, Reprints, *Quasicrystals, *Icosahedral phase, Three dimensional.

The authors describe three-dimensional graphics modeling experiments executed on a calligraphic system. Using precise data from neutron diffraction, a triple icosahedral shell has been identified in the α -(AlSi)-Mn phase. These triple shells are centered in the unit cell; the (Pm 3-bar) structure is completed by double shells on the cube corners. The triple shell can also be viewed as a composite of twelve coordination icosahedra around the manganese sites on the second (MacKay) shell.

801,232

PB88-217955

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Interpenetrating Incommensurately Modulated Lattices with Icosahedral Symmetry.

Final rept.,

R. D. Spal. 1986, 4p

Pub. in Physical Review Letters 56, n17 p1823-1826, 28 Apr 86.

Keywords: *Crystal structure, Reprints, *Quasicrystals, *Icosahedral phase.

The paper derives an infinite class quasiperiodic lattices, composed of incommensurately modulated sublattices with displacive modulations, whose diffraction patterns have icosahedral symmetry. The sublattice reference lattices, as well as the sublattice displacement fields, belong to the space group (R 3-bar m), and are equivalent under the icosahedral point group. These quasiperiodic lattices are fundamentally different from those constructed by the projection and grid methods. Nevertheless, a special displacement field reproduces a three-dimensional generalization of the Penrose tiling.

801,233

PB88-217971

Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Apparatus Design for Glow-Discharge a-Si:H Film-Deposition.

Final rept.,

A. Gallagher. 1988, 12p

Sponsored by Solar Energy Research Inst., Golden, CO.

Pub. in International Jnl. of Solar Energy 5, p311-322 1988.

Keywords: *Semiconducting films, *Silicon, *Glow discharges, Deposition, Design, Reprints, *Amorphous silicon, Silicon solar cells.

Attention is drawn to several important details of a discharge deposition apparatus, and to how these can affect film quality. Some reasons are suggested for how and why film quality depends on deposition conditions, and what might be done to improve both film quality and deposition rate. Considered are what appear to be three major causes of poor film quality: deposition of microparticulates, ion bombardment of the growing film surface, and growth by sticky radicals (radicals with a high sticking coefficient to the surface).

801,234

PB88-228200

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Scanning Electron Microscopy with Polarization Analysis (SEMPA).

Final rept.,

R. J. Celotta, J. Unguris, and D. T. Pierce. 1987, 2p

See also PB88-117619.

Pub. in Proceedings of Annual Meeting of the Electron Microscopy Society of America (45th), p178-179 1987.

Keywords: *Magnetic domains, *Electron microscopy, Ferromagnetic materials, Microstructure, *Scanning electron microscopy, *Electron spin polarization.

The technique of Scanning Electron Microscopy with Polarized Analysis (SEMPA) is described, and examples are given of its application to the study of magnetic microstructure.

801,235

PB88-228242

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Electron Spin Polarization Analyzers for Use with Synchrotron Radiation.

Final rept.,

D. T. Pierce, R. J. Celotta, M. H. Kelley, and J.

Unguris. 1988, 10p

Grant NSF-DMR86-03304

Sponsored by Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.

Pub. in Nuclear Instruments and Methods in Physics Research A266, p550-559 1988.

Keywords: *Analyzers, Synchrotron radiation, Photoelectrons, Photoelectron emission, Polarization (Spin alignment), Magnetic properties, Reprints, *Electron spin polarization.

The measurement of the spin polarization of photoelectrons emitted from a magnetic material is discussed. An important consideration is the acceptance phase space of the spin analyzer relative to the phase space of the photoemitted electrons to be measured. Other considerations include the magnetization direction relative to the extracted beam and whether the measurements are angle integrated or angle resolved. Different spin analyzers are described and compared, and an analysis of the application to different spin polarized photoemission measurement configurations is given.

801,236

PB88-228283

Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Effect of Oxygen Annealing on Low-Resistivity Contacts for High-T (sub c) Superconductors.

Final rept.,

J. W. Ekin, A. J. Panson, and B. A. Blankenship.

1988, 4p

Sponsored by Department of Energy, Washington, DC. Pub. in Materials Research Society Symposia Proceedings, v99 p283-286 1988.

Keywords: *Superconductors, *Electric contacts, *Annealing, Electrical resistivity, Gold, Silver, Oxygen, *High temperature superconductors, Yttrium barium cuprates, Barium copper yttrium oxides.

A method for making low resistivity contacts to high-Tc superconductors has been developed, consisting of depositing noble metal contact pads (silver or gold) on a clean superconductor surface at low temperatures (< 150 deg C). After annealing the silver contact pads in oxygen at intermediate temperatures (= or < 500 C) for one hour, contact resistivities less than 2×10 to the -8th power ohm-cm sq at 76 K are obtained, about six orders of magnitude less than for indium-solder contacts. Before annealing, the contact resistivities are still very low, in the 10 to the -6th to 10 to the -5th ohm-cm sq range at 76 K, which would be useful when contacts with low fabrication temperatures are required. The voltage-current characteristics of the contacts are strongly nonlinear after annealing, having a superconducting transition character. This is ascribed to the critical current of the superconducting material being exceeded at the contact interface. External connections to the contact pads have been made using both solder and thermosonic wire-bonding techniques.

801,237

PB88-230552

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Disclinations: The Magnetism and the Magnetic Anisotropies of the Rare-Earth-3d Transition-Metal Hard Magnets (Invited).

Final rept.,

R. E. Watson, L. H. Bennett, and M. Melamud. 1988,

3p

Contract DE-AC02-76CH00016

See also DE88-001339. Sponsored by Department of Energy, Washington, DC.

Pub. in Jnl. of Applied Physics 63, n8 p3136-3138, 15 Apr 88.

Keywords: *Rare earth alloys, *Chemical bonds, Magnetic anisotropy, Intermetallics, Reprints, *Iron neodymium borides, *Iron neodymium, Disclinations, Transition element alloys, Ligands, Magnetism.

An important class of hard magnets, involving rare earth and 3d transition metals and sometimes metal-oids, includes Nd₂Fe₁₄B and Nd₂Fe₁₇. The authors have noted a correlation between the local site magnetism in these two compounds and whether those sites lie on nets of so-called major ligand lines or dis-

clinations, i.e., bond lines shared by six common nearest neighbors. They have proposed that a criterion for choosing candidate alloys with strong 3d moments is the occurrence of such disclination nets, and using this criterion, have listed several structures having 3d sites with this characteristic. They have also rationalized the crystal field anisotropies as relating to the orientation of the major ligand lines.

801,238

PB88-230560

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Constricted Diamagnetic Hysteresis Loops Observed for the High T (sub c) Superconductors.

Final rept.,

U. Atzmony, R. D. Shull, C. K. Chiang, L. J.

Swartzendruber, L. H. Bennett, and R. E. Watson.

1988, 3p

Contract DE-AC02-76CH00016

Sponsored by Department of Energy, Washington, DC. Pub. in Jnl. of Applied Physics 63, n8 p4179-4181, 15 Apr 88.

Keywords: *Superconductors, *Magnetic hysteresis, Electrical resistivity, Reprints, *High temperature superconductors, *Barium copper yttrium oxides, *Yttrium barium cuprates, Magnetic susceptibility, Hysteresis loops.

Magnetic hysteresis loops, ac susceptibility, and resistivity measurements have been made on a Ba₂YCu₃O(7-x)-type high-T(c) superconductor. The shape of the hysteresis loops well below T(c) are reminiscent of constricted hysteresis loops observed in certain ferromagnetic materials which are usually associated with magnetic aftereffects. Similar dynamic effects, with a time constant on the order of 10 s at 40 K, are shown to be present in the superconducting material. The dynamic magnetic viscosity effect is in addition to the flux creep observed for longer time periods.

801,239

PB88-230566

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Magnetic Behavior of Both Superconducting Thin Films and Their Deposition Targets.

Final rept.,

K. Moorjani, J. Bohandy, F. J. Adrian, B. F. Kim, U.

Atzmony, R. D. Shull, C. K. Chiang, L. J.

Swartzendruber, and L. H. Bennett. 1988, 3p

Pub. in Jnl. of Applied Physics 63, n8 p4199-4201, 15 Apr 88.

Keywords: Magnetic hysteresis, Thin films, Reprints, *Superconducting films, *Lanthanum strontium cuprates, *Barium yttrium cuprates, Yttrium barium cuprates, Barium copper yttrium oxides, Magnetic susceptibility, Laser applications.

The superconducting properties of the bulk oxides La_{1.85}Sr_{0.15}CuO(4-x) and Ba(2)YCu(3)O(7-y) were investigated through their magnetic behavior by vibrating-sample magnetometry and complex ac susceptibility, and by dc resistivity and microwave response. These oxides were then used as targets in the preparation of thin films using a laser-ablation technique. The superconducting properties of the films were established through their microwave response. The M-H loops at low temperatures clearly establish the type-II behavior of the Ba-Y-Cu-O materials. The real part of the ac susceptibility showed the superconducting transition. Simultaneously, the imaginary part of the ac susceptibility showed the existence of nonsuperconducting portions in the samples which have a low enough resistivity to carry a significant amount of current. The novel method of microwave response was used to detect the superconductivity for both the bulk oxides and the thin films.

801,240

PB88-230594

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Magnetic Properties of Thin-Film Ag+Iron-Oxide Granular Metals.

Final rept.,

R. D. Shull, U. Atzmony, A. J. Shapiro, L. J.

Swartzendruber, L. H. Bennett, W. J. Green, and K.

Moorjani. 1988, 3p

Pub. in Jnl. of Applied Physics 63, n8 p4261-4263, 15 Apr 88.

PHYSICS

Solid State Physics

Keywords: *Iron oxides, *Paramagnetic materials, Thin films, Metal films, Mossbauer effect, Magnetic hysteresis, Electron microscopy, Granular materials, Reprints.

The magnetic properties of iron-oxide particulates dispersed in silver (prepared by rf diode sputtering silver and iron oxide over a wide composition range) have been investigated using the Mossbauer effect, electron microscopy, and vibrating sample magnetometry. The sputtered films are nanocrystalline mixtures of immiscible particles of the two constituents (even when only a very small amount of silver is present). At room temperature, the Mossbauer effect data show that for most compositions (even those with low silver content) the majority of the film is superparamagnetic, with the fraction of material in the superparamagnetic state increasing with increasing Ag content. Consistent with these results, very narrow hysteresis loops were observed. On decreasing the temperature to near 100 K, the fraction of material in the superparamagnetic state decreased and the magnetically ordered component increased.

801,241

PB88-237425

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Dependence of Inelastic Electron Mean Free Paths on Electron Energy and Material (Summary Abstract).

Final rept.,

S. Tanuma, C. J. Powell, and D. R. Penn. 1988, 2p. Pub. in Jnl. of Vacuum Science and Technology A 6, n3 p1041-1042 May/June 88.

Keywords: *Electron beams, *Mean free path, Inelastic scattering, Electron energy, Surfaces, Reprints, Electron spectroscopy, eV range 100-1000, KeV range 1-10.

A summary is given of new calculations of inelastic electron mean free paths of 100-2000 eV electrons in 31 materials. On the basis of these calculations, a general formula has been developed to determine the dependence of the inelastic mean free path on electron energy for a given material, and the material-dependence for a given energy. Examples of the results for silicon are presented.

801,242

PB88-237433

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Radiation Enhanced Diffusion (RED) in a Sputtered Ag/Ni Layered System.

Final rept.,

D. Marton, J. Fine, and G. P. Chambers. 1987, 10p. Pub. in Proceedings of Diffusion at Interfaces: Microscope Concepts Workshop, Campobello, Island, Canada, August 18-22, 1987, p111-120.

Keywords: *Interfaces, Metal films, Thin films, Silver, Nickel, Sputtering, *Radiation enhanced diffusion.

Radiation enhanced diffusion was observed during the AES sputter depth profiling of multilayered Ag/Ni thin films. The findings can be interpreted in terms of interface broadening due to two main factors: (1) surface roughening and (2) radiation enhanced diffusion of Ag. Both factors can be analytically described using some simple approximations and within the framework of these approximations it has been possible to separate the symmetric broadening contribution from that of the asymmetric RED component. The measurement of the diffusion rate indicates that it is proportional to the sputtering current density in keeping with the theory of RED developed by Dienes and Damask.

801,243

PB88-237441

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

X-ray Photoelectron Forward Scattering Studies of Epitaxial Overlayers and Sandwich Structures of Au and Ag on Ni(100).

Final rept.,

W. F. Egelhoff. 1988, 5p. Pub. in Jnl. of Vacuum Science and Technology A 6, n3 p730-734 May/June 88.

Keywords: *Epitaxy, *Silver, *Gold, Metal films, Nickel, Substrates, Reprints, *X ray photoelectron spectroscopy, *Photoelectron spectroscopy, Low energy electron diffraction.

Angle-resolved x-ray photoelectron spectroscopy (XPS) has been used to study the short-range order (SRO) in epitaxial layers (1-73 monolayers) of Ag and Au on Ni(100). The basis for the technique is the enhancement of core-level intensities which occur along nearest-neighbor axes in the lattice due to photoelectron forward scattering. The XPS results indicate the Ag and Au films are very different in structure. The results demonstrate the importance of XPS forward scattering as a probe of SRO in epitaxial films.

801,244

PB88-238613

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Electronic Structure of the Icosahedral and Other Phases of Aluminum-Manganese Alloys Studied by Soft-X-ray Emission Spectroscopy.

Final rept.,

D. L. Ederer, R. Schaefer, K. L. Tsang, C. H. Zhang, T. A. Callcott, and E. T. Arakawa. 1988, 4p.

Grant NSF-DMR85-03541

Sponsored by National Science Foundation, Washington, DC., Department of Energy, Washington, DC., and Air Force Office of Scientific Research, Arlington, VA. Pub. in Physical Review B 37, n15 p8594-8597, 15 May 88.

Keywords: *Aluminum manganese alloys, X ray spectra, Emission spectra, Reprints, *Electronic structure, *Icosahedral phase, *Quasicrystals, Soft x rays, Density of states.

Aluminum L(2,3) soft-x-ray emission spectra have been observed for several aluminum-manganese alloys exhibiting icosahedral, decagonal, and the normal crystalline symmetries. The spectra of all the alloys are qualitatively similar and are slightly narrower (about 0.2 eV) than the width observed for metallic aluminum. Compared to the sample with crystalline symmetry, the quasicrystals show no chemical shift and a decrease in the partial density of states of s and d symmetry at the Fermi energy, contradicting the predictions of several calculations.

801,245

PB88-238639

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Composition Control of the Microstructure of Ba₂YCu₃O(6+x).

Final rept.,

J. E. Blendell, C. A. Handwerker, M. D. Vaudin, and E. R. Fuller. 1988, 8p.

Pub. in Jnl. of Crystal Growth 89, p93-100 1988.

Keywords: *Superconductors, Chemical composition, Microstructure, Sintering, Grain boundaries, Impurities, Carbon, Reprints, *High temperature superconductors, *Barium copper yttrium oxides, *Yttrium barium cuprates, Critical current.

Although Ba₂YCu₃O(6+x) exhibits superconductivity at high temperatures, the critical current density (J_c) in bulk polycrystalline materials, prepared by sintering, is several orders of magnitude below useful values. One possible source of low J_c in polycrystalline materials is the presence of resistive grain boundary junctions resulting from second phases or impurity segregation. Chemical composition plays a major role in determining the phases present and hence the grain boundary characteristics. Preliminary composition measurements of Ba₂YCu₃O(6+x) include the ratio of major elements, impurity concentrations at the trace level, compositional mapping of major elements by electron probe microanalyses, and observations of sintered microstructures. Results on liquid phase formation and carbon contamination introduced during powder processing and from exposure to atmospheric CO₂ indicate that a great degree of compositional control is required for any meaningful characterization of the Ba-Y-Cu-O system.

801,246

PB88-241849

PC A04/MF A01

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Break Junctions 1.

Interim rept. 1 Oct 86-31 Sep 87, J. Moreland, L. F. Goodrich, J. W. Ekin, T. E. Capobianco, and A. F. Clark. May 88, 74p NBSIR-88/3090

Sponsored by Office of Naval Research Branch Office, Pasadena, CA.

Keywords: *Electron tunneling, Energy gap, *High temperature superconductors, *Superconducting junctions,

*Break junctions, Lanthanum strontium cuprates, Yttrium barium cuprates, Barium yttrium cuprates.

Measurements of the tunneling current-voltage characteristics of break junctions in conventional superconductors can be used to determine their superconducting energy gap as a function of energy. These results agree with those previously obtained using traditional oxide tunneling barriers. Break junctions in some exotic superconductors, on the other hand, have anomalous current-voltage characteristics compared to BCS predictions. Energy gaps and the Josephson effect measured for the new high T_c materials YBaCuO (T_c=93 K) and LaSrCuO (T_c=36 K) indicate that the samples are inhomogeneous with varying gap functions depending on the location of the tunneling contact within the break junction fracture. Break junction data for these materials are within the strong coupling limits of BCS theory.

801,247

PB89-101299

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Valence-Band Effective Masses of GaAs.

Final rept.,

J. R. Lowney, and A. H. Kahn. 1988, 4p. Pub. in Jnl. of Applied Physics 64, n1 p447-450, 1 Jul 88.

Keywords: *Gallium arsenides, *Valence bands, Computation, Reprints, *Effective mass, Density of states.

The density-of-states effective masses for the heavy-hole, light-hole, and split-off valence bands of GaAs have been calculated as a function of energy for each band. The calculations are based on a full k.p theory with the most recent values used for the matrix elements. Provision has been made for the effect of the split-off energy on the matrix elements of the split-off band. The results show important nonparabolicities which should be taken into account in modeling the valence band, and rational polynomial fits have been made for ease of computation.

801,248

PB89-101380

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Scanning Electron Microscopy with Polarization Analysis: Studies of Magnetic Microstructures. Summary Abstract.

Final rept.,

R. J. Celotta, J. Unguris, and D. T. Pierce. 1988, 2p. Sponsored by Office of Naval Research, Arlington, VA.

Pub. in Jnl. of Vacuum Science and Technology A 6, n3 p574-575 May/June 88.

Keywords: Thin films, Microstructure, Reprints, *Scanning electron microscopy, Electron spin polarization, *Magnetic surfaces, *Surface magnetism, Amorphous materials.

A scanning electron microscope provides a view of the physical microstructure of a sample by imaging the secondary electrons ejected as a function of incident electron beam position. By measuring the orientation of the magnetic moment of these electrons using a spin polarization detector, an image of the magnetic microstructure of the sample can be simultaneously obtained. Images which describe the vector magnetization of the sample surface can be obtained with a resolution characteristic of the microscope, e.g. 100 Å.

As the spin orientation of the secondary electrons is independent of their number, such images are only affected by surface topography to the extent that it affects magnetic structure. Descriptions of the theoretical and experimental basis of the technique, its embodiment in an ultra-high vacuum SEM, and its salient features are presented. The types of measurements possible are illustrated with examples, including magnetic crystals, glasses, thin film devices, and ultra-thin magnetic overlayers.

801,249

PB89-101638

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Resistivity of Linear Scratches in Doped (100) n-type Single-Crystal Silicon.

Final rept.,
S. Danyluk, S. W. Lee, J. H. Ahn, and A. H. Kahn.
1988, 4p
Sponsored by Solar Energy Research Inst., Golden, CO.
Pub. in Jnl. of Applied Physics 63, n9 p4568-4571, 1 May 88.

Keywords: *Silicon, *Electrical resistivity, *Scratches, Single crystals, Damage, Surfaces, Wafers, Reprints, N-type semiconductors, Doped materials, Probes(Electromagnetic), Four point probes.

Four-point probe measurements have been made on (100) n-type Czochralski silicon wafers of initial resistivities 0.016, 0.96, and 3.35 ohm cm. The probe tips straddled linear single scratches formed by a Vickers pyramid diamond. The diamond was dead-loaded with 0.25 N, and the scratches were made in a laboratory air environment with a relative humidity of 50 percent, as the silicon wafer was held at various elevated temperatures. The measurements show that the relative change in resistivity increases with temperature up to an optimum temperature, after which the resistivity decreases. The temperature at which the maximum occurs and at which the relative change in resistivity occurs depends on the initial resistivity of the wafers; the temperature at which the maximum change in relative resistivity occurs is 200 C for the 0.016- and 0.96-ohm cm wafers and 250 C for the 3.35-ohm cm wafer.

801,250

PB89-107221 Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Desorption of a Two-State System: Laser Probing of Gallium Atom Spin-Orbit States from Silicon (100).

Final rept.,
K. L. Carleton, B. Bourguignon, and S. R. Leone.
1988, 20p
Grants NSF-PHY86-04504, NSF-CHE86-08403
Sponsored by National Science Foundation, Washington, DC., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Surface Science 199, p447-466 1988.

Keywords: *Silicon, *Desorption, Spin orbit interactions, Surfaces, Gallium arsenides, Reprints, *Gallium atoms, L-S coupling, Laser induced fluorescence, Epitaxial growth.

The interactions of gallium atom spin-orbit states with silicon (100) surfaces are studied by temperature programmed desorption (TPD) using laser-induced fluorescence detection. State-resolved sticking coefficients are measured and are found to be unity for both spin-orbit states (doublet P(1/2), doublet P(3/2), Delta E=2.5 kcal/mol, 10.5 kJ/mol) up to surface temperatures of 1000 K. A Redhead analysis of the state-specific TPD spectra yields essentially identical energies and pre-exponential factors for both spin-orbit states. The results are of interest in the epitaxial growth of GaAs on Si(100).

801,251

PB89-119051 Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Al-Mn mu Phase and Its Relation to Quasicrystals.

Final rept.,
L. Bendersky, 1987, 10p
Pub. in Jnl. of Microscopy 146, p303-312 Jun 87.

Keywords: *Crystallography, *Aluminum, Manganese, Crystal structure, Electron diffraction, Alloys, Crystal symmetry, Reprints, *Quasicrystals.

The crystallography of the hexagonal mu phase has been studied using convergent beam and selected area electron diffraction. Point group 6/mmm and space group P6(sub 3)/mmc were derived. Analysis of electron diffraction intensities suggests that the mu phase has a structural skeleton of icosahedral units in three orientations. The same approach was used to analyze the structures of icosahedral, decagonal and lambda phases. The major conclusion is that different crystalline and quasiperiodic phases of AlMn composition can be formed by different stacking of the same icosahedral clusters, possibly of Mackay icosahedron type.

801,252

PB89-119085 Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Formation of Quasicrystals.

Final rept.,
L. A. Bendersky, and R. J. Schaefer. 1986, 8p
Pub. in Physica A 140, n1-2 p298-305 1986.

Keywords: *Crystal structure, *Intermetallic compounds, Nucleation, Crystal symmetry, Alloys, Reprints, *Quasicrystals.

It has recently been discovered that 'quasicrystalline' intermetallic phases can form which have point group symmetries not allowed in periodic crystals; icosahedral, with six five-fold axes, and decagonal, with one 10-fold axis. These phases have long-range orientational order, but they must have translational quasiperiodicity. They usually form at alloy compositions close to those of intermetallic compounds which have crystal structures containing icosahedral groups of atoms. The quasicrystal phases nucleate preferentially in supercooled melts, thus replacing the equilibrium phases.

801,253

PB89-119093 Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Glass Formation in Systems Forming Icosahedral Quasicrystals.

Final rept.,
L. A. Bendersky, and S. D. Ridder. 1987, 5p
Pub. in Proceedings of Science and Technology of Rapidly Quenched Alloys Symposium, Boston, MA., December 1-3, 1986, p349-353 1987.

Keywords: *Crystal structure, *Aluminum, *Manganese, *Crystallography, Nucleation, Alloys, Crystal symmetry, Reprints, *Quasicrystals, *Metallic glasses.

EHD atomization has been used to rapidly solidify micron and submicron size droplets of Al-14 a/o Mn to study the possibility of glass formation and nucleation behavior of icosahedral phase. Icosahedral grain size has been found to decrease continuously with decreasing droplet size. Based on this result, formation of the icosahedral phase is explained by homogeneous nucleation. Extremely low resistance to nucleation of icosahedral phase can be understood if possible topological similarities between liquid and icosahedral quasicrystals are considered. Formation of glass as configurationally frozen liquid in Al-Mn and similar alloy systems is questionable, implying that the reported Al-Mn glass probably has a microquasicrystalline structure.

801,254

PB89-119135 Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Nucleation Behavior of Al-Mn Icosahedral Phase.

Final rept.,
L. Bendersky, and S. D. Ridder. 1986, 10p
Pub. in Jnl. of Materials Research 1, n3 p405-414 May/June 86.

Keywords: *Nucleation, *Aluminum, *Manganese, *Crystal structure, *Crystallography, Alloys, Crystal symmetry, Reprints, *Quasicrystals, *Metallic glasses.

EHD atomization has been used to rapidly solidify micron and submicron size droplets of Al-14 a/o Mn to study nucleation behavior of icosahedral phase. Icosahedral grain size has been found to decrease continuously with decreasing droplet size. Based on this result, formation of the icosahedral phase is explained by homogeneous nucleation. Extremely low resistance to nucleation of icosahedral phase can be understood if possible topological similarities between liquid and icosahedral quasicrystal are considered. Formation of glass as configurationally frozen liquid in Al-Mn and similar alloy systems is questionable, implying that the reported Al-Mn glass probably has a microquasicrystalline structure.

801,255

PB89-119218 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Total Dielectric Function: Algebraic Sign, Electron-Lattice Response, and Superconductivity.

Final rept.,
P. B. Allen, M. L. Cohen, and D. R. Penn. 1988, 13p
Pub. in Physical Review B 38, n4 p2513-2525, 1 Aug 88.

Keywords: *Superconductivity, Phonons, Stability, Reprints, Mean-field theory, Dielectric functions.

The interaction between two test charges in a solid can be described in terms of a total dielectric function that includes electronic and lattice polarization. Crystal stability requires the eigenvalues of 1/epsilon to be = or less than 1. Some implications for superconductivity are discussed. A total dielectric function for the electron-lattice system is derived in the mean-field approximation and its inverse is explicitly constructed. The low-lying poles of 1/epsilon give the correct phonon frequencies as determined by the usual dynamical matrix.

801,256

PB89-123780 Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Production of High-Quality Amorphous Silicon Films by Evaporative Silane Surface Decomposition.

Final rept.,
J. Doyle, R. Robertson, G. H. Lin, M. Z. He, and A. Gallagher. 1988, 9p
Sponsored by Solar Energy Research Inst., Golden, CO.
Pub. in Jnl. of Applied Physics 64, n6 p3215-3223, 15 Sep 88.

Keywords: Semiconducting films, Thin films, Silane, Reprints, *Amorphous silicon, *Silicon solar cells, Chemical vapor deposition.

High-quality hydrogenated amorphous silicon films (a-Si:H) have been produced by decomposition of low-pressure silane gas on a very hot surface with deposition on a nearby, typically 210 deg C substrate. A high-temperature tungsten filament provides the surface for heterogeneous thermal decomposition of the low-pressure silane and subsequent evaporation of atomic silicon and hydrogen. These evaporated species (primarily) induce a-Si:H growth on nearby substrates which are temperature controlled using a novel substrate holder. The light and dark conductivities, optical band gap, deposition rates, and light-soaking effects of preliminary films are reported. The decomposition-evaporation process has been examined using a mass spectrometer to directly detect the decomposition rate and the evaporated radical species. Based on this data and other information, a simplified model for the deposition process is suggested. The excellent film quality and the attributes of the deposition process make this technique, which was originally suggested by Wiessman, viable for the fast rate, large-area deposition of a-Si:H for solar cells and other applications.

801,257

PB89-124036 Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD.

Physics of Fracture.

Final rept.,
R. Thomson. 1986, 129p
See also PB83-234658.
Pub. in Solid State Physics, v39 p1-129 1986.

Keywords: *Crystal structure, *Fractures(Materials), *Elastic theory, *Atomic structure, Cracking(Fracturing), Shielding, Reprints, Dislocations.

The general concept underlying the fracture of crystals is reviewed. The elasticity of cracks as well as dislocations is presented in a complete fashion so that full results can be derived for forces between dislocations and cracks. The latest theories and observations of the atomic structure of cracks are given and then applied to the emission of dislocations from cracks. The ductile-brittle duality of material behavior is explained in terms of the atomic structure of cracks and the interactions of dislocations with the crack. The concept of dislocation shielding is explored and the ability of dislocations to toughen the material through the shielding of the crack is explained and analyzed.

801,258

PB89-124960 Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

PHYSICS

Solid State Physics

International Conference on Low Temperature Physics (LT-18) (18th).

Final rept.,
J. Moreland, and H. Hirabayashi. 1988, 2p
Pub. in Cryogenics 28, n8 p543-544 Aug 88.

Keywords: *Low temperature research, *Meetings, Cryogenics, Reprints.

Summary of the 18th International Conference on Low Temperature Physics (LT-18).

801,259

PB89-124986

Not available NTIS

National Bureau of Standards (NBS), Boulder, CO. Electromagnetic Technology Div.

Relationships between Critical Current and Stress in NbTi.

Final rept.,
J. W. Ekin. 1987, 4p
Sponsored by Department of Energy, Washington, DC. Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-23, n2 p1634-1637 Mar 87.

Keywords: *Superconductors, *Niobium inorganic compounds, *Titanium inorganic compounds, Low temperature tests, Stresses, Tension, Compressing, Strains, Filaments, Reprints, Critical current.

The effects of various types of stress on the critical current of a multifilamentary NbTi superconductor are reported. Degradation of critical current due to axial tension applied at 4 K, transverse compression applied at 4 K, and hairpin bending strain applied at room temperature has been measured. The degradation from axial tension is much greater than from transverse compression in many practical cases because the soft copper matrix limits the buildup of transverse compression. The degradation from typical levels of transverse compression is only about 4% at 8 T, for example. For axial tension, on the other hand, higher stresses can occur that will degrade the critical current by 24%, for example, at 7 T and 2.7% strain. Both the axial-tensile and the transverse compressive stress effects are about 98% reversible; thus the degradation will be seen only when the conductor is under operational stress. The results indicate that a primary origin of the critical current degradation in NbTi is stress-induced reversible decrease in the upper critical field.

801,260

PB89-124994

Not available NTIS

National Bureau of Standards (NBS), Boulder, CO. Electromagnetic Technology Div.

Thermally Induced Escape: The Principle of Minimum Available Noise Energy.

Final rept.,
R. L. Kautz. 1988, 15p
Grant N00014-88-F-0018
Sponsored by Office of Naval Research, Washington, DC. Pub. in Physical Review A 38, n4 p2066-2080, 15 Aug 88.

Keywords: *Josephson junctions, *Thermal noise, Superconductivity, Monte Carlo method, Simulation, Reprints, Josephson effect, Johnson noise.

The average time required for thermally induced escape from a basin of attraction increases exponentially with inverse temperature in proportion to $\exp(E(A)/kT)$ in the limit of low temperature. A minimum principle states that the activation energy $E(A)$ is the minimum available noise energy required to execute a state-space trajectory which takes the system from the attractor of the noise-free system to the boundary of its basin of attraction and that the minimizing trajectory is the most probable low-temperature escape path. This principle is applied to the problem of thermally induced escape from two attractors of the dc-biased Josephson junction, the zero-voltage state and the voltage state, to determine activation energies and most probable escape paths. These two escape problems exemplify the classical case of escape from a potential well and the more general case of escape from an attractor of a nonequilibrium system. Monte Carlo simulations are used to verify the accuracy of the activation energies and most probable escape paths derived from the minimum principle.

801,261

PB89-126437

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Stability of a Planar Interface During Solidification of a Multicomponent System.

Final rept.,
S. R. Coriell, G. B. McFadden, P. W. Voorhees, and R. F. Sekerka. 1987, 8p
Pub. in Jnl. of Crystal Growth 82, n3 p295-302 Mar 87.

Keywords: *Crystal structure, *Ternary systems, *Metal alloys, Stability, Interfaces, Solidification, Melting points, Reprints.

A fully time-dependent analysis of the morphological stability of a planar interface during directional solidification of a multicomponent alloy at constant velocity is carried out for a simple model in which each solute acts independently. The authors show that there are no linearly unstable modes that are oscillatory in time for either (1) equal thermal properties in crystal and melt, (2) equal temperature gradients in melt and crystal, or (3) the thermal steady state approximation. The stability-instability demarcation is analyzed, and numerical results are presented for ternary alloys.

801,262

PB89-126833

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Ammonium Perchlorate Structure and Dynamics at Low Temperatures.

Final rept.,
H. J. Prask, C. S. Choi, N. J. Chesser, and G. J. Rosasco. 1988, 17p
Pub. in Jnl. of Chemical Physics 88, n8 p5106-5122, 15 Apr 88.

Keywords: *Ammonium perchlorate, *Low temperature tests, *Crystal structure, *Lattice vibrations, Neutron diffraction, Dynamics, Phase transformations, Raman spectroscopy, Scattering, Reprints.

Single-crystal and powder neutron diffraction, coherent neutron inelastic scattering, and Raman spectroscopy have been used to study the low temperature structure and dynamics of ammonium perchlorate. No evidence for a phase transition is found. Based on analysis of thermal motion amplitudes and inelastic neutron-scattering data for ND sub 4 ClO sub 4 a Raman-active B sub 3g symmetry zone-center mode at 45 cm sup minus 1 is identified as a libration. Another Raman-active mode, B sub 1g symmetry at 33 cm sup minus 1, and a previously unobserved A sub u symmetry mode at 12 cm sup minus 1, are inferred to have significant librational character at $q=0$. Comparison of these results with earlier incoherent neutron scattering results suggests that, because of the low activation energy of ammonium ions, classical jump reorientations strongly influence ammonium-ion sublattice dynamics even to temperatures as low as 20 K. Partial dispersion curves are also presented.

801,263

PB89-126841

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Direct Observation of the Charge-Density-Wave in Potassium by Neutron Diffraction.

Final rept.,
T. M. Giebultowicz, A. W. Overhauser, and S. A. Werner. 1986, 4p
Pub. in Physical Review Letters 56, n14 p1485-1488, 7 Apr 86.

Keywords: *Potassium, Neutron diffraction, Reprints, *Charge density, Phonons.

Sharp charge-density-wave satellites in potassium have been located at (0.995, 0.975, 0.015). They are smaller than the 110 reflections by about 100,000, and each is surrounded by a prolate ellipsoidal cloud of diffuse phason scattering, having its major axis along a line through the 110.

801,264

PB89-131262

(Order as PB89-131254, PC A04)

National Bureau of Standards, Gaithersburg, MD.

Diffraction Imaging (Topography) with Monochromatic Synchrotron Radiation.

B. Steiner, M. Kuriyama, R. C. Dobbryn, and U. Laor. 19 May 88, 25p
Included in Jnl. of Research of the National Bureau of Standards, v93 n5 p577-601 May 88.

Keywords: *Crystal growth, *Monochromatic radiation, *Diffraction, Crystal defects, Crystallography, Synchrotron radiation, Electrooptics, *Imaging techniques.

Structural information of special interest to crystal growers and device physicists is now available from resolution monochromatic synchrotron diffraction imaging (topography). In the review, the importance of superior resolution in momentum transfer and in space is described, and illustrations are taken from a variety of crystals: gallium arsenide, cadmium telluride, mercuric iodide, bismuth silicon oxide, and lithium niobate. The identification and detailed understanding of local variations in crystal growth processes are shown. Finally, new experimental opportunities now available for exploitation are indicated.

801,265

PB89-132740

Not available NTIS

National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Elastic Constants of Polycrystalline Y1Ba2Cu3O7-x.

Final rept.,
H. M. Ledbetter, S. A. Kim, and D. W. Capone. 1988, 7p
Pub. in Proceedings of Materials Research Society Spring Meeting, High-Temperature Superconductors II, Reno, NV., April 5-9, 1988, 7p.

Keywords: *Ceramics, *Superconductors, *Elastic properties, *Acoustic velocity, Yttrium oxides, Barium oxides, Copper oxides, Temperature, Poisson ratio.

The elastic constants of a polycrystalline Y(sub 1)Ba(sub 2)Cu(sub 3)O(sub 7-x) superconductor between 295 and 4 K are reported. Roughly speaking, the elastic constants behave regularly. However, small departures from regular behavior provide much interest. The following conclusions are drawn from the measurements: (1) Elastic constants show irregularities below and above T(sub c). During cooling, all the elastic constants show an irregularity near 200 K. (2) Within measurement error (about 1 part in 1000), none of the elastic stiffnesses show an abrupt change at T(sub c), 91 K. (3) Below T(sub c), all the elastic constants show regular behavior, except Poisson ratio. (4) During cooling, between 160 and 70 K, the material behaves like it undergoes a sluggish phase transformation. (5) The large (4%) decrease in Poisson ratio is unexpected. It indicates large interatomic-force changes. (6) The unusual flatness of Poisson ratio (T) near 295 K suggests unusual material-property changes above ambient temperatures.

801,266

PB89-132781

Not available NTIS

National Bureau of Standards (NBS), Boulder, CO. Electromagnetic Technology Div.

Recent Tunneling Measurements of 90 K Superconductors at NBS (National Bureau of Standards).

Final rept.,
J. Moreland, J. A. Beall, R. H. Ono, and A. F. Clark. 1988, 3p
Pub. in Proceedings of Extended Abstracts High-Temperature Superconductors II Meeting, Reno, NV., April 5-9, 1988, p351-353.

Keywords: Electron tunneling, Energy gap, *High temperature superconductors, *Yttrium barium cuprates, *Barium yttrium cuprates, *Superconducting films, Superconducting junctions.

Several tunneling measurements on oxide superconductors have been made at NBS in the last year. These include break junction tunneling measurements of the energy gap, break junction superconducting point contacts, and the operation of a break junction point contact rf SQUID above 77 K. Until recently, these tunneling experiments have been limited to bulk samples cut from sintered pellets and a few small single crystals. The authors present here further results on thin films of YBa2Cu3Ox (YBCO) using squeezable electron tunneling (SET) junctions. In contrast to the break junction tunneling experiments on bulk samples, where quite often tunneling spectra are without energy gap features, the spectra for thin-film SET junctions are rich with structure.

801,267

PB89-132799

Not available NTIS

National Bureau of Standards (NBS), Boulder, CO. Electromagnetic Technology Div.

Single Crystal HoBa₂Cu₃O_x Break Junctions.

Final rept.,
J. Moreland, A. F. Clark, M. A. Damento, and K. A. Gschneidner. 1988, 2p
Grant N00014-88-F-0013
Sponsored by Office of Naval Research Branch Office, Pasadena, CA.
Pub. in *Physica C*, p1383-1384 1988.

Keywords: *Superconductors, Single crystals, Ejection tunneling, Energy gaps, Reprints, *Break junctions, *High temperature superconductors, *Holmium barium cuprates, *Barium holmium cuprates, Superconducting junctions.

Tunneling spectra of HoBa₂Cu₃O_x single crystals, using the break junction method, show energy gap features. These features are variable from junction to junction, possibly due to an anisotropic gap function. The I-V curves show the peculiar square law dependence of the current on voltage seen in many tunneling measurements of polycrystalline samples of 90 K superconductors. This may be an indication of an inherent 'granularity' built into the superconducting matrix of a single crystal.

801,268

PB89-132807 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.

X-ray Scattering Studies: The Structure and Melting of Pb on Cu(110) Surfaces.

Final rept.,
S. Brennan, P. H. Fuoss, and P. Eisenberger. 1985, 6p
Pub. in *Structure of Surfaces*, p421-426 1985.

Keywords: *X-ray diffraction, *Crystal structure, *Lead, *Copper, *Monomolecular films, *Covering, Coatings, Phase transformations, Scattering, Melting points, Temperature, Surface properties, Reprints.

Grazing Incidence X-ray Scattering (GIS) studies of Pb deposited on Cu(110) have been performed to determine the crystal structure of two of the low-coverage phases and to measure the melting temperature of the Pb overlayer as a function of coverage. The high-density monolayer has a four-atom unit cell which is commensurate with the Cu substrate in the (001) and (110) directions whereas the low-density monolayer consists of a two-atom unit cell which remains commensurate in the (001) direction but is incommensurate in the (110) direction. At very high coverages islands of Pb form which seem to be bulk-like in their diffraction and which exhibit a seemingly first order phase transition but which melt at 246 deg C, 80 deg C below the bulk Pb melting temperature. From approximately two monolayers of Pb down to slightly below one monolayer the surface melts in an apparent second order phase transition at temperatures ranging from 220 deg C up to 320 deg C. Below one monolayer coverage in the incommensurate phase the melting temperature decreases and the discommensuration increases with decreasing coverage. The melt transition seems to remain the same order as in the commensurate phase.

Structural Mechanics

801,269

PB88-177480 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.

Customized Force Calibration: Matching Laboratory Tests to Field Conditions.

Final rept.,
R. A. Mitchell. 1985, 5p
Pub. in *ASTM (American Society for Testing and Materials) Standardization News*, p48-51 Oct 85.

Keywords: Reprints, Analytical models, *Eccentric load sensitivity, *Environmental sensitivity, Force calibration, Force measurement.

A customized force calibration to better match calibration measurements to field conditions is proposed. An approach to developing such a calibration process is outlined, including: (1) determination of performance requirements; (2) development of appropriate laboratory tests; (3) development of analytical models relating laboratory tests to performance requirements. Several examples of progress in developing a customized calibration process are given.

801,270

PB89-124978 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Spherical Wave Operators and the Translation Formulas.

Final rept.,
R. C. Wittmann. 1988, 10p
Pub. in *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Antennas and Propagation* 36, n8 p1078-1087 Aug 88.

Keywords: *Spherical waves, Greens function, Wave equations, Reprints, *Helmholtz equations.

Translation formulas for both scalar and vector spherical wave solutions of the Helmholtz equation are developed in a straightforward manner using differential operator representations for the modal functions and well-known expressions for the scalar and dyadic free-space Green's functions. The expansion coefficients are given in compact integral or differential operator forms useful for analytic investigation.

General

801,271

PB88-173935 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Dynamics and Symmetries in Intense Field Multiphoton Processes: Floquet Theoretical Approaches.

Final rept.,
S. I. Chu. 1986, 64p
Pub. in *Advances in Multi-Photon Processes and Spectroscopy*, v3 p175-238 Jul 86.

Keywords: *Multi-photon processes, Ion-atom collisions, Charge-exchange interactions, Laser radiation, Floquet theory.

Several recently developed Floquet theoretical approaches for ab initio studies of (i) multiphoton excitation of molecules, (ii) SU(N) dynamical evolution and nonlinear coherence of N-level systems in polychromatic fields, and (iii) laser-induced multi-charged ion-atom collisions are reviewed.

801,272

PB88-173943 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

What Causes the Sharp Positron Spectrum in Heavy Atom Collisions: The Atomic Hypothesis.

Final rept.,
W. Lichten. 1985, 6p
Pub. in *Proceedings of Atomic Theory Workshop*, Gaithersburg, MD., May 23-24, 1985, p319-324.

Keywords: *Positrons, Emission spectra, *Atomic collisions, Autoionization.

The author found that the resemblance between the positron emission spectra and those found in autoionization during atomic collisions is strong enough to make an atomic explanation a plausible, if unproven, alternative to the nuclear and elementary particle explanations. The objections raised to this explanation are founded on calculations which are too incomplete to be conclusive. Therefore, the author continues to offer the hypothesis that the peaks in the positron spectra could be caused by purely atomic phenomena.

801,273

PB88-174800 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Background Fluctuations and Wegner Corrections.

Final rept.,
J. F. Nicoli, and P. C. Albright. 1986, 6p
Pub. in *Physical Review B* 34, n3 p1991-1996, 1 Aug 86.

Keywords: *Specific heat, Reprints, Wegner series.

The authors examine the relationship between the leading amplitude of the specific heat, the first Wegner correction term, and the fluctuation-induced analytic term. A proposed universal relation among these

quantities is shown to be incorrect. The authors also discuss the limit of validity for the Wegner series and its radius of convergence.

801,274

PB88-175096 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.

Laser-Cooling and Electromagnetic Trapping of Neutral Atoms.

Final rept.,
W. D. Phillips, H. J. Metcalf, and J. V. Prodan. 1985, 17p
See also PB88-175104, and PB88-175138.
Pub. in *Jnl. of the Optical Society of America B: Opt. Phys.* 2, n11 p1751-1767 1985.

Keywords: Atomic beams, Reprints, *Atom traps, Laser cooling, Laser trapping, Magnetic traps, Trapping(Charged particles).

Atoms in a thermal beam can be cooled, decelerated, and stopped using the radiation pressure from a nearly resonant laser beam. Several groups have already used the laser cooling process on an atomic sodium beam. In the paper the authors review the techniques and results of the various experimental groups. The authors discuss applications of laser-cooled atoms, including the possibility of confining them in electromagnetic traps.

801,275

PB88-175104 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.

Laser Cooling, Stopping, and Magnetic Trapping of Neutral Atoms.

Final rept.,
W. D. Phillips. 1985, 50p
See also PB88-175096, and PB88-175138.
Pub. in *Jnl. of the Optical Society of America A-Optics and Image Science* 2, n13 50p 1985.

Keywords: Atomic beams, Laser beams, Reprints, *Atom traps, Laser cooling, Trapping(Charged particles), Magnetic traps.

An atomic beam is cooled and stopped using the radiation from a resonant laser beam. The stopped atoms are trapped in a magnetic quadrupole.

801,276

PB88-175112 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.

Laser-Cooling and Trapping Neutral Atoms.

Final rept.,
W. D. Phillips. 1985, 16p
See also AD-A146 048. Sponsored by Office of Naval Research, Arlington, VA.
Pub. in *Ann. Phys.* 10, n6 p717-732 Dec 85.

Keywords: Optical pumping, Reprints, *Atom traps, Laser cooling, Trapping(Charged particles), Laser trapping, Magnetic traps.

The NBS-Gaithersburg experiments on laser deceleration and cooling of atomic beams is reviewed. The laser-cooling process is presented as an example of the 'Lumino-refrigeration' by optical pumping originally proposed by Kastler. Prospects for using laser-cooled atoms in magnetostatic or radiative atom traps are discussed.

801,277

PB88-175120 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.

First Observation of Magnetically Trapped Neutral Atoms.

Final rept.,
A. L. Migdall, J. V. Prodan, W. D. Phillips, T. H. Bergeman, and H. J. Metcalf. 1985, 4p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in *Physical Review Letters* 54, n24 p2596-2599, 17 Jun 85.

Keywords: Reprints, *Atom traps, Laser cooling, Trapping(Charged particles), Sodium atoms, Magnetic traps.

The authors report the first observation of trapping of neutral atoms. Laser-cooled and stopped sodium atoms are confined in a magnetic quadrupole trap formed by two opposed, separated, coaxial current

loops. The lifetime in the trap exceeds 0.8 s and is limited mainly by collisions with background gas atoms.

801,278
PB88-175138 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Electromagnetic Trapping of Neutral Atoms.
Final rept.,
H. Metcalf, and W. D. Phillips. 1986, 8p
See also PB88-175096, and PB88-175104.
Pub. in Metrologia 22, n4 p271-278 1986.

Keywords: Magnetic fields, Direct current, Reprints, *Atom traps, Laser cooling, Laser trapping, Trapping(Charged particles), High resolution, Magnetic bottles.

Electromagnetic trapping of neutral atoms is a new branch of applied physics that has potential for use in very many areas, including high resolution precision spectroscopy. The authors present an introduction to trapping in both dc magnetic fields and optical frequency fields (laser beams). The basic ideas and fundamental limitations are discussed, and the first successful experiments are reviewed.

801,279
PB88-175187 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Electron Atom Collision Studies Using Optically State Selected Beams: Superelastic Scattering (Abstract).
Final rept.,
J. J. McClelland, M. H. Kelley, and R. J. Celotta. 1985, 1p
Pub. in Proceedings of International Conference on the Physics of Electronic and Atomic Collisions (14th), Palo Alto, CA., July 24-30, 1985, p185.

Keywords: Reprints, *Electron scattering, *Spin polarization.

The abstract describes the authors efforts in the past year and a half in the program to study spin dependent effects in collisions between spin polarized electrons and spin polarized atoms. First, the authors have undertaken a rather extensive investigation, both experimental and theoretical, of the laser optical pumping process with particular emphasis on certain details applicable to the preparation of a spin polarized beam of sodium atoms. Second, they have begun a series of measurements to study spin dependent effects in superelastic scattering from the 3P 3/2 state in sodium.

801,280
PB88-175229 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Convergent Analysis of Radiative Matrix Elements in Atomic Lineshape Theory.
Final rept.,
F. H. Mies, P. S. Julienne, Y. B. Band, and S. J. Singer. 1986, 16p
Pub. in Jnl. of Physics B 19, n20 p3249-3264, 28 Oct 86.

Keywords: *Absorption, Reprints, *Atomic lineshape, *Close coupling, Dressed states, Impact limit.

For dipole allowed atomic transitions are radiative matrix element which defines the pressure-broadened atomic lineshape is only conditionally convergent. Using a commutator technique to redefine the integral, the authors isolate, and ultimately reject, the contribution of an indeterminate asymptotic surface integral that is associated with the binary collision of the atom and its perturber. The remaining contributions which are absolutely convergent, give the multichannel atomic lineshape which includes effects of non-adiabatic and inelastic scattering. Further the authors show the relationship of the commutator integral to the exact requirements of close-coupled scattering theory for radiatively-induced collisions. The scattering analysis suggests the interpretation of the convergent lineshape as an expression of multichannel inelastic collisions between field-dressed atomic states. The same interpretation applies both in the impact and the static limit. In the paper the authors make explicit comparisons which demonstrate the equivalence between the commutator integral and the numerical close-coupled results in the weak-field limit. Here the authors emphasize the static limit, well in the wings of the atomic line, where the Jablonski stationary phase WKB analysis is often applied with good effect.

801,281
PB88-175385 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Deconvolution of Neutron Depth Profiling Spectra.
Final rept.,
J. T. Maki, R. F. Fleming, and D. H. Vincent. 1986, 9p
Pub. in Nuclear Instruments and Methods in Physics Research B17, n2 p147-155 Sep 86.

Keywords: Helium 3, Neutron spectra, Neutron depth profiling, Deconvolution, Nitrogen 14, Iterative methods.

Iterative methods for determining true depth profiles from measured neutron depth profiling (NDP) energy spectra are presented. The methods account for energy broadening caused by system noise, energy straggling, multiple small angle scattering, and geometrical acceptance angles. Examples of the methods are given for known and unknown depth profiles of helium-3 and nitrogen-14.

801,282
PB88-175674 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Photoabsorption by the 3d Shell in Ce, Pr, Ho, and Er: Observations and Calculations.
Final rept.,
J. Sugar, W. D. Brewer, G. Kalkowski, G. Kaindl, and E. Paparazzo. 1985, 7p
Pub. in Physical Review A 32, n4 p2242-2248 Oct 85.

Keywords: *Cerium, *Erbium, *Holmium, *Praseodymium, *Absorption spectra, Synchrotron radiation, Reprints, *Photoabsorption, X radiation.

Improved 3d photoabsorption spectra of the series of rare-earth fluorides have been obtained by recording total electron yield and using monochromatized synchrotron radiation. They are compared with predicted spectra resulting from an average-of-configuration calculation of wavefunctions employing radial integrals adjusted to the observed spectrum in each case; results are presented here for Ce, Pr, Ho and Er spectra. Improved resolution of the Ce spectrum permitted for the first time a determination of the proper scaling for all of the electrostatic parameters.

801,283
PB88-176508 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Electromagnetic Technology Div.
Activation Energy for Thermally Induced Escape from a Basin of Attraction.
Final rept.,
R. L. Kautz. 1987, 5p
Grant N00014-86-F-0065
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physics Letters A 125, n6-7 p315-319, 23 Nov 87.

Keywords: *Activation energy, Reprints, Josephson effect, Bistability.

In the limit of low temperature, the most probable path for escape from a basin of attraction is the path which minimizes the available thermal noise energy required for escape. This minimum energy is the activation energy of escape.

801,284
PB88-176771 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
X-ray Monochromator Crystal Which Detects the Bragg Condition.
Final rept.,
T. Jach, D. Novotny, G. Carver, J. Geist, and R. D. Spal. 1988, 3p
Pub. in Nuclear Instruments and Methods in Physics Research A263, p522-524 1988.

Keywords: *Monochromators, X ray diffraction, Bragg angle, Silicon, Reprints.

The authors have fabricated a (111) silicon X-ray monochromator crystal with a diode diffused into its surface. Without suffering any apparent degradation in its or rocking-curve width at the Bragg condition, the crystal provides a dc current which changes dramatically at the diffraction of a monochromatic x-ray beam. The current change is directly attributable to extinction at

the Bragg angle. It provides a new means to align the two crystals of a double-crystal x-ray monochromator using a feedback circuit.

801,285
PB88-176862 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Quantum Mechanics and Precision Measurements.
Final rept.,
N. F. Ramsey. 1987, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p155-157 Jun 87.

Keywords: *Fundamental constants, *Measurement, Precision, Reprints, *Quantum mechanics.

The quantum mechanical foundation of modern precision physical measurements is discussed, with emphasis on five key features of quantum mechanics which underlie such measurements. It is argued that quantum theory affords more advantages than limitations for achieving high precision in determination of fundamental constants and related quantities.

801,286
PB88-176912 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
X-ray Attenuation Cross Sections for Energies 100 eV to 100 keV and Elements Z = 1 to Z = 92.
Final rept.,
E. B. Saloman, J. H. Hubbell, and J. H. Scofield. 1988, 197p
Pub. in Atomic Data and Nuclear Data Tables 38, p1-197 1988.

Keywords: *X rays, *Absorption cross sections, Far ultraviolet radiation, Reprints, Soft x radiation, EV range 100-1000, KeV range 01-10, KeV range 10-100.

The work presents for the energy range 0.1-100 keV the National Bureau of Standards (NBS) database of experimental x-ray attenuation coefficients (total absorption cross sections) and cross sections calculated using a relativistic Hartree-Slater model for the photoelectric cross section for all elements of atomic number $Z = 1-92$. The information is displayed in both tabular and graphical form. Also shown on the graphs are cross sections obtained using the semiempirical set of recommended values of B.L. Henke and co-workers (Atomic Data and Nuclear Data Tables 27, 1 (1982)). A bibliography of the NBS database for the energy range is included.

801,287
PB88-177407 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Relativistic Effects in Electron-Atom Collisions.
Final rept.,
Y. K. Kim, and J. P. Desclaux. 1987, 5p
Grant NATO-85/0744
Sponsored by North Atlantic Treaty Organization, Brussels (Belgium), and Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Physica Scripta 36, p796-800 1987.

Keywords: *Ions, Reprints, *Electron atom collisions, *Relativistic distorted wave.

Relativistic effects in electron-atom collision cross sections are discussed. According to the results obtained using the relativistic distorted-wave Born approximation, relativistic cross sections for electron-impact excitations of Li-like ions are smaller than corresponding nonrelativistic cross sections. The reduction results mostly from relativistic contraction of bound orbitals and from spin-orbit splitting. The authors found that electron exchange and orthogonality between bound and continuum orbitals did not significantly alter cross sections for highly charged ions.

801,288
PB88-177415 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Radiance of a Pt/Cr-Ne Hollow Cathode Spectral Line Source.
Final rept.,
J. Z. Klose, and J. M. Bridges. 1987, 2p
Pub. in Applied Optics 26, n24 p5202-5203, 15 Dec 87.

Keywords: *Atomic radiation, *Calibrated source, Chromium, Neon, Platinum, Radiance, Radiation standard, Radiometry, Spectral lines, Reprints, Hollow cathode.

A source has been developed which produces a rather uniform distribution of spectral lines over the wavelength range from 115 nm to approx. 800 nm. The source is a sealed lamp with a hollow cathode of 10% chromium and 90% platinum and a fill gas of neon. Spectral lines emitted by platinum cover the range 115 nm to 320 nm, those from chromium span the range 320 nm to 540 nm, and those from neon extend upwards of 540 nm. A description of the source and measurements of the radiances of a number of the spectral lines are given along with error analyses of the measured values.

801,289

PB88-177456

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Measurements of Excitation Rate Coefficients for Al-Like Ions: Fe XIV, Ni XVI, and Cu XVII.

Final rept.,
R. U. Datla, J. R. Roberts, R. D. Durst, W. L. Hodge, C. C. Klepper, W. L. Rowan, and J. B. Mann. 1987, 3p

Contract DE-AC05-78ET053043

Sponsored by Department of Energy, Washington, DC. Pub. in Physical Review A 36, n1 p5448-5450, 1 Dec 87.

Keywords: *Copper, Tokamak, Rates, Excitation, Iron, Intensities, Nickel, Reprints.

Absolute excitation rate coefficients for Fe XIV and Ni XVI ions are measured spectroscopically in the Texas Experimental Tokamak. Previous measurements for the 3d-3p transition array of Cu XVII are verified and the measurements are extended to the 3s3p(2)->3s(2)3p transition array of this ion. The experimental rate coefficient for the 3d-3p transition array of Fe XIV is 6.2 times 10 to the minus 9 power cm(3)s(-1) at an electron temperature near 160 eV and for Ni XVI and Cu XVII, the values are 4.2 times 10 to the minus 9 power and 3.8 times 10 to the minus 9 power cm(3)s(-1), respectively, at an electron temperature near 240 eV. For the 3s3p(2)(2)P(3/2)->3s(2)3p(2)P(3/2) transition array, the experimental excitation rate coefficient for Fe XIV is 8.2 times 10 to the minus 9 power cm(3)s(-1) at an electron temperature near 160 eV and for Ni XVI and Cu XVII the value is 5.5 times 10 to the minus 9 power cm(3)s(-1) at an electron temperature near 240 eV. The uncertainty in these results is estimated to be + or - 50% (one standard deviation). Computed values of absolute excitation rates in a distorted-wave approximation and Mewe's semiempirical formula are found to be in good agreement with the experimental values.

801,290

PB88-177555

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Development of the NBS (National Bureau of Standards) (10)Be/(9)Be Isotopic Standard Reference Material.

Final rept.,
K. G. W. Inn, S. Raman, B. M. Coursey, J. D. Fassett, and R. L. Walker. 1987, 5p
Pub. in Nuclear Instruments and Methods in Physics Research B29, p27-31 1987.

Keywords: Reprints, *Beryllium, *Liquid scintillation, Radioactivity, Reference material, Tandem accelerator mass spectrometry.

The National Bureau of Standards (NBS), in conjunction with the Oak Ridge National Laboratory (ORNL) and the Accelerator Mass Spectrometry (AMS) community, is in the process of developing a (40)Be/(9)Be isotopic solution Standard Reference Material (SRM). The starting (10)Be/(9)Be solution was provided by the ORNL after Secondary Ionization Mass Spectrometric characterization for isotopic concentration. The radioactivity purity of the ORNL Master solution was confirmed by gamma-ray spectrometry, then diluted at NBS with solutions made from zone-refined single-crystal beryllium metal and sub-boiling double-distilled hydrochloric acid. Four serial dilutions were necessary to achieve a final (10)Be/(9)Be isotopic composition of approximately 3 x 10(-11). The accuracy of the dilutions was confirmed by liquid scintillation and AMS measurements. The isotopic composition of the ORNL Master solution was also confirmed at NBS by Reso-

nant Ionization Mass Spectrometry. The isotopic composition of the final solution is being confirmed at the present time through international laboratory AMS measurements.

801,291

PB88-177563

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Detectors for Neutron Scattering in the eV Region.

Final rept.,
R. G. Johnson. 1988, 9p
Pub. in Nuclear Instruments and Methods in Physics Research A263, p427-435 1988.

Keywords: Reprints, *Bismuth germanate, *Condensed matter physics, Detectors, High purity germanium, Neutron scattering, Resonance detector spectrometer.

With the advent of high-current high-energy proton accelerators used as pulsed neutron sources for condensed matter studies, interest in extending neutron scattering measurements to the eV region has increased. Among the instruments proposed is the resonance-detector spectrometer (RDS) which uses the sharp low-energy nuclear resonance (usually capture) to define the energy of the scattered neutron. These spectrometers require detectors with high efficiency and good background rejection. Two promising candidates for such detectors, a bismuth germanate (BGO) scintillator and a high-purity germanium (HPGe) detector have been tested at the NBS neutron time-of-flight facility. These tests used simple recoil scattering at high scattering angles and several different resonance foils. Efficiencies and signal to background ratios were measured.

801,292

PB88-187554

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Multiphoton Processes in Intense Laser Fields.

Final rept.,
S. I. Chu. 1986, 18p
Pub. in Chinese Jnl. of Physics 24, n1 p1-18 1986.

Keywords: Reprints, *Multi-photon processes, Multiphoton ionization, Photoionization, Floquet theory, Laser radiation.

An introduction to several recent new developments in semi-classical Floquet theories and quasi-energy methods for perturbative and nonperturbative treatments of intense field multiphoton excitation (MPE), ionization (MPI), and dissociation (MPD) of atoms and molecules is presented.

801,293

PB88-188503

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Frequency Standards Based on Atomic Hydrogen.

Final rept.,
F. L. Walls. 1986, 5p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) 74, n1 p142-146 Jan 86.

Keywords: *Frequency standards, Frequency stability, Cryogenics, Reprints, *Hydrogen masers.

The current state of hydrogen maser frequency standards is reviewed. Particular emphasis is placed on the discussion of physical mechanisms which affect long-term stability. While questions concerning absolute accuracy still remain, recent experiments suggest that long-term stability can be at least as good as the best primary standards (1 x 10 to the -13th power). The long-term stability can be realized by small passive hydrogen maser field standards, a fact which makes this an attractive alternate to cesium field standards. Hydrogen masers already exhibit the best short-term stability of any room temperature atomic clock, and this could be improved by a factor of 100 with the atomic development of hydrogen masers operating at cryogenic temperatures.

801,294

PB88-189543

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.

Coherent Synchrotron Relaxation Oscillation in an Electron Storage Ring.

Final rept.,
G. Rakowsky. 1985, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-32, n5 p2377-2379 Oct 85.

Keywords: Oscillations, Reprints, *Surf II storage ring, *Storage rings.

Detailed observations of the slow fluctuation of the stored beam in the NBS 280 MeV electron storage ring (SURF II) reveal a relaxation-type oscillation, in which brief intervals of dipole mode bunch oscillation alternate with relatively long recovery intervals free of coherent oscillations. A simple phase modulation model of the dipole oscillation shows that an infinite number of modulation sidebands develop around each RF harmonic of the beam. These vary in amplitude as the oscillation grows, giving the appearance of turbulence. The model reveals a self-limiting feedback mechanism which limits the growth of the oscillation. Graphic data illustrating this behavior are presented.

801,295

PB88-189667

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.

Cooling, Stopping, and Trapping Atoms.

Final rept.,
A. L. Migdall, T. Bergeman, J. Dalibard, H. Metcalf, W. D. Phillips, J. V. Prodan, and I. So. 1985, 5p
Sponsored by Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.
Pub. in Proceedings of International Conference on Laser Spectroscopy VII (7th), Maui, HI., June 24-28, 1985.

Keywords: Atomic beams, Precision, *Atom traps, Magnetic traps, Laser cooling, Laser trapping, Laser spectroscopy.

The authors have developed a method of providing atoms with low enough kinetic energy to be contained in the many extremely shallow traps that have been proposed for neutral atoms. They have demonstrated this by successfully loading a magnetic trap. This is the first conclusive evidence of trapped atoms. The authors believe this is a general technique, capable of loading any of the atom traps proposed.

801,296

PB88-189832

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Behavior of Turbine and Venturi Flowmeters in Superfluid Helium.

Final rept.,
D. E. Daney. 1988, 9p
Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Pub. in Advances in Cryogenic Engineering, v33 p1071-1079 1988.

Keywords: *Superfluidity, *Venturi meters, *Flowmeters, Liquid helium, Reprints, *Turbine instruments, Calibration.

Turbine and Venturi flowmeters were calibrated in both normal and superfluid helium in an apparatus designed specifically for that purpose. Simple in concept, the facility forces liquid helium from a calibrated bellows through the flowmeter. An ambient temperature stepping motor drives the welded stainless steel bellows whose capacity is 10 L. Flow rates range up to 0.35 L/s, and helium temperatures span from 1.25 K to 4.0 K. For the 9.3 mm bore turbine meter, identical meter factors are obtained for normal and superfluid helium. For the Venturi meter, discharge coefficients between 0.98 and 1.0 are obtained with normal and superfluid.

801,297

PB88-189840

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Cavitation in Flowing Superfluid Helium.

Final rept.,
D. E. Daney. 1988, 5p
Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Pub. in Cryogenics 28, p132-136 Feb 88.

PHYSICS

General

Keywords: *Superfluidity, *Cavitation, Liquid helium, Thermal conductivity, Reprints.

Flowing superfluid helium cavitates much more readily than normal liquid helium, and there is a marked difference in the cavitation behavior of the two fluids as the lambda point is traversed. Examples of cavitation in a turbine meter and centrifugal pump are given, together with measurements of the cavitation strength of flowing superfluid helium. The authors attribute the unusual cavitation behavior of superfluid helium to its immense thermal conductivity.

801,298

PB88-189857

Not available NTIS

National Bureau of Standards (NBS), Boulder, CO. Chemical Engineering Science Div.

Development and Experimental Test of an Analytical Model of the Orifice Pulse Tube Refrigerator. Final rept.,

P. J. Storch, and R. Radebaugh. 1988, 9p

Contract NASA-A-34964-C

Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.

Pub. in *Advances in Cryogenic Engineering*, v33 p851-859 1988.

Keywords: *Refrigerators, Helium, Nitrogen, Models, Reprints, *Pulse tube refrigerators, *Cryocoolers.

The promise of high reliability and high refrigeration capacity is responsible for a recent surge of interest in pulse tube refrigeration. The work involves the development of an analytical model describing behavior of the orifice pulse tube to gain a better understanding of the refrigeration process. Due to oscillating gas flow, the system is described in terms of average enthalpy flow with such simplifying assumptions as an ideal gas and sinusoidal pressure variation. Phasor analysis is used to represent the temperature, pressure, and mass flow rate waves in vector form. Also discussed in the paper is the verification of the model in which analytical predictions are compared to experimental measurements.

801,299

PB88-189865

Not available NTIS

National Bureau of Standards (NBS), Boulder, CO. Chemical Engineering Science Div.

Electronic Balance for Weighing Foams at Cryogenic Temperatures. Final rept.,

R. O. Voth, and J. D. Siegwarth. 1988, 7p

Contract SANL-623-001

Sponsored by Lawrence Livermore National Lab., CA. Pub. in *Advances in Cryogenic Engineering*, v33 p1089-1095 1988.

Keywords: *Weight indicators, *Foam, Electric equipment, Reprints, *Balances, Liquid hydrogen, Cryogenic equipment.

A commercial electronic balance was altered to weigh objects in a cryogenic environment containing combustible fluids. The balance was used to measure the mass gain of open cellular foams touching the surface of liquid hydrogen. The mass gain rate is a function of the foam wicking characteristics (a function of the foam structure). Weighing the empty and liquid filled foam sample in the ullage above the liquid, and the foam submerged in the liquid, gives sufficient information to allow a free volume or porosity to be determined for the foam. These tests are especially important for foams too weak to withstand the surface tension forces of ambient temperature liquids. Details of the design of the cryogenic balance and some results for several types of foams are presented in the paper.

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801,300

PB88-189881

Not available NTIS

National Bureau of Standards (NBS), Boulder, CO. Chemical Engineering Science Div.

Miniature Cryogenic High Vacuum Valve. Final rept.,

J. D. Siegwarth, and R. O. Voth. 1988, 7p

Contract SANL-623-001

Sponsored by Lawrence Livermore National Lab., CA. Pub. in *Advances in Cryogenic Engineering*, v33 p1153-1159 1988.

Keywords: *High vacuum valves, Reprints, *Liquid hydrogen, Cryogenic equipment.

A small high vacuum valve has been built for use in a liquid hydrogen handling system. The valve stem tip consists of a polycarbonate resin which closes against

a stainless steel seat. Other features of the valve include a closing mechanism that is helium gas operated and a bellows stem seal that allows the valve to open and close without changing the internal volume.

801,301

PB88-193339

PC A05/MF A01

National Bureau of Standards (NBS), Gaithersburg, MD. Center for Analytical Chemistry.

X-ray Bremsstrahlung Intensities from Elemental Targets. Technical note (Final),

J. A. Small, D. E. Newbury, and R. L. Myklebust. Feb 88, 91p NBS/TN-1245

Also available from Supt. of Docs.

Keywords: *Bremsstrahlung, *X rays, Electron energy, Mathematical modeling, Measurement, Background radiation, Electron flux density.

Recently NBS reported on the modeling of bremsstrahlung radiation generated from elemental targets by 10-40 keV electrons. The x-ray measurements were made on 44 elemental targets with atomic numbers ranging from 4 to 92. Up to 19 different x-ray intensities were recorded on each target at each of 7 electron accelerating voltages. The data set is considerably more comprehensive than previous data sets, consisting of approximately 4100 data points. No such large data set of x-ray bremsstrahlung measurements is available in the literature for the electron energies of 10-40 keV.

801,302

PB88-193917

Not available NTIS

National Bureau of Standards (NBS), Boulder, CO. Electromagnetic Fields Div.

Lattice Approach to Complex Electromagnetic Environments. Final rept.,

J. Randa, and M. Kanda. 1986, 3p

Pub. in *IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Electromagnetic Compatibility*, San Diego, CA., September 16-18, 1986, p329-331.

Keywords: *Electromagnetic environments, Maxwell's equations, Finite difference theory, Numerical integration, Computation.

An approach is outlined to the characterization of complicated electromagnetic environments, based on a lattice (finite difference) approximation to Maxwell's equations. Approximate solutions to the equations are found numerically, subject to constraints imposed by boundary conditions and by measurements of the field at some number of points. The technique is illustrated by simple two and three dimensional examples.

801,303

PB88-194485

Not available NTIS

National Bureau of Standards (NBS), Gaithersburg, MD. Center for Radiation Research.

Coulomb Effects in Asymptotic Normalization Constants: A Soluble Model. Final rept.,

D. R. Lehman, L. C. Maximon, and J. L. Friar. 1988, 13p

Sponsored by Department of Energy, Washington, DC. Pub. in *Physical Review C* 37, n1 p336-348 Jan 88.

Keywords: *Coulomb interactions, Helium 3, Tritium, Three body problem, Reprints.

An exactly soluble two-body model is used to investigate Coulomb effects on S-wave asymptotic normalization constants. The model consists of an S-wave separable interaction with and without a repulsive Coulomb interaction. Relative to the case without the Coulomb interaction, it is shown explicitly that an S-wave asymptotic normalization constant is affected in two compensating ways by the presence of the Coulomb interaction: (1) The asymptotic norm decreases due to the decrease in binding energy; (2) the asymptotic norm increases due to the modification in the tail of the wave function brought about by the long-range nature of the Coulomb interaction. For a system such as (3)He, these are approximately 5% effects that essentially cancel each other, leading to nearly equal asymptotic normalization constants for (3)H and (3)He.

801,304

PB88-194501

Not available NTIS

National Bureau of Standards (NBS), Boulder, CO. Chemical Engineering Science Div.

Performance of a Small Centrifugal Pump in He I and He II. Final rept.,

P. R. Ludtke, D. E. Daney, and W. G. Steward. 1988, 10p

Contract NASA-A-21059-C

Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.

Pub. in *Advances in Cryogenic Engineering*, v33 p515-524 1988.

Keywords: *Liquid helium, *Centrifugal pumps, *Superfluidity, Performance, Reprints.

The performance and NPSH requirements for a small centrifugal pump were measured over the temperature range of 1.6 to 4.2 K. A close-coupled cryogenic induction motor powers the single stage pump which has a 50 mm diameter impeller. The pump performance (head and capacity) was the same for both He I and He II, in the absence of cavitation. Developed heads up to 16 m and capacities up to 900 L/h are achieved at 7000 rpm. Both a six-blade propeller inducer and a three-blade screw inducer were tested. The screw inducer requires significantly less suction head than the propeller design; the NPSH requirements are less than -100 mm for He I, and depending on flow rate, range between 35 and 165 mm for He II.

801,305

PB88-194527

Not available NTIS

National Bureau of Standards (NBS), Gaithersburg, MD. Surface Science Div.

Dependence of Inelastic Electron Mean Free Paths on Electron Energy and Material. Final rept.,

S. Tanuma, C. J. Powell, and D. R. Penn. 1987, 3p. Pub. in *Analytical Electron Microscopy*, p356-358 1987.

Keywords: *Electron beams, *Mean free path, Inelastic scattering, Surfaces, Electron energy, EV range 100-1000, KeV range 01-10.

Calculations have been made of the inelastic mean free paths (IMFPs) of 300-2000 eV electrons in 27 elements and 4 compounds, using a new algorithm due to Penn. The calculated IMFPs have been fitted to the Bethe equation for each material, have been empirically related to several material parameters (density, atomic or molecular weight, number of valence electrons, and bandgap energy for non-conductors). The resulting general formula allows convenient determination of the IMFP dependence on electron energy for a given material and the material dependence for a given energy.

801,306

PB88-195037

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Technological University of Nagaoka. Final rept.,

A. L. Dragoo. 1987, 3p

Pub. in *Scientific Bulletin* 12, n4 p45-47 1987.

Keywords: Ion beams, Surfaces, Desorption, Reprints, *Nagaoka University.

A visit to the Technological University of Nagaoka (Nagaoka, Japan) is reported. Research in material science, ion beam physics, and surface science is briefly described.

801,307

PB88-196803

Not available NTIS

National Bureau of Standards (NBS), Gaithersburg, MD. Center for Radiation Research.

Electromagnetic Excitation of the Delta Resonance in Nuclei. Final rept.,

J. S. O'Connell. 1988, 19p

See also PB87-231452.

Pub. in *AIP (American Inst. of Physics) Conference Proceedings 163--Pion-Nucleus Physics: Future Directions and New Facilities at Lampf*, Los Alamos, NM., 1987, p465-483 1988.

Keywords: Electron scattering, Excitation, Photonuclear reactions, *Delta resonances.

Photon and electron reactions with nuclei are reviewed for which the excitation energy is in the delta region. The role of the first nucleon resonance as an interme-

diated state in electromagnetic nuclear reactions is examined above and below pion threshold.

801,308

PB88-198916

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Spin Sensitivity of a Channel Electron Multiplier.

Final rept.,

R. E. Scholten, J. J. McClelland, M. H. Kelley, and R. J. Celotta. 1988, 3p

Sponsored by Department of Energy, Washington, DC. Pub. in Review of Scientific Instruments 59, n3 p506-508 Mar 88.

Keywords: Electron spin, Electron scattering, Reprints, *Electron multipliers, Polarized beams, eV range 10-100.

The authors report direct measurements of the sensitivity of a channel electron multiplier to electrons with different spin orientations. Four regions of the multiplier cone were examined, using polarized electrons at 100-eV incident energy. Pulse counting and analog modes of operation were both investigated, and, in each case, the observed spin effects were less than 0.5%.

801,309

PB88-198932

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Test of the Isotropy of the Speed of Light Using Fast-Beam Laser Spectroscopy.

Final rept.,

E. Riis, L. U. A. Andersen, N. Bjerre, O. Poulsen, S. A. Lee, and J. L. HALL. 1988, 4p

Grant NSF-PHY85-08594

Sponsored by National Science Foundation, Washington, DC.

Pub. in Physical Review Letters 60, n2 p81-84, 11 Jan 88.

Keywords: Atomic beams, Anisotropy, Relativity, Reprints, *Light speed, Laser spectroscopy.

The authors report on a novel experiment sensitive to the anisotropy of the one-way speed of light. The frequency of a two-photon transition in a fast atomic beam is compared to the frequency of a stationary absorber while the direction of the fast beam is rotated relative to the fixed stars. The experiment yields an improved upper limit for the anisotropy: $\Delta c/c = \text{or} < 3 \times 10^{-10}$ to the 9th power.

801,310

PB88-198965

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Hg Resonance Lamp with Controlled 254-nm Line Profiles for Transient Temperature Measurements.

Final rept.,

W. Braun, I. Price, and M. D. Scheer. 1987, 3p

Pub. in Review of Scientific Instruments 58, n12 p2271-2273 Dec 87.

Keywords: *Temperature measurement, *Mercury lamps, Near ultraviolet radiation, Reprints, Line broadening, Temperature dependence, Transients.

A new method has been described elsewhere for measuring transient temperature changes using the absorption of the 254-nm resonance radiation from an optically thick Hg lamp by traces of Hg vapor. The method is based upon the fact that the Hg resonance lines broaden in a known way with increasing temperature and pressure. The sensitivity and dynamic range of the temperature measurement depends upon the extent of line reversal which varies with the optical depth of the Hg lamp. It is shown here that this can be controlled by means of a proper lamp design. The mounting assembly for the lamp and the circuitry required for this purpose are described. It was demonstrated that the output of such a lamp is stable and reproducible with line profiles (optical densities) that could be varied over about a 20-fold range. Within such a range of operating parameters, the measurement of transient temperature to 1500 K in gases at pressures below 100 Torr could be made.

801,311

PB88-198973

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

National Bureau of Standards Atomic Data Centers: Review of Recent and Imminent Publications.

Final rept.,

J. Sugar. 1988, 4p

Pub. in Spectrochimica Acta 43B, n1 p21-24 1988.

Keywords: *Atomic energy levels, *Transition probabilities, *Collision cross sections, *Bibliographies, Wavelengths, Reprints.

The past, present and near future compilations and bibliographies of atomic data by the three data centers of the National Bureau of Standards are reviewed. They include the topics of atomic transition probabilities, wavelengths, energy levels, and collision cross-sections. All but the last are prepared at the Gaithersburg, MD, site while cross-sections are compiled at the Joint Institute for Laboratory Astrophysics (JILA) at Boulder, CO. Only brief remarks regarding the JILA work are given to call attention to this activity.

801,312

PB88-200274

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Semiclassical Interpretation of Eigenvectors for Excited Atoms in External Fields.

Final rept.,

J. B. Delos, R. L. Waterland, and M. L. Du. 1988, 23p

Pub. in Physical Review A 37, n4 p1185-1207, 15 Feb 88.

Keywords: Excitation, Atoms, *WKB approximation, *Eigenvectors.

Eigenvectors for an electron in an atom in parallel electric and magnetic fields are calculated, and a semiclassical interpretation of their behavior is obtained. Eigenvectors can in this case be regarded as 'wave functions in angular momentum space'. The matrix equation defining the eigenvectors is written as a difference equation, and then converted to a pseudodifferential equation; a systematic procedure is then used to construct a semiclassical approximation. It is found that the same classical Hamiltonian that has been previously used to calculate semiclassical eigenvalues provides a WKB-type representation of the eigenvectors. The development sheds new light on action-angle formulations of quantum mechanics and on semiclassical approximations in action-angle variables.

801,313

PB88-204847

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Time and Frequency (Time-Domain) Characterization, Estimation, and Prediction of Precision Clocks and Oscillators.

Final rept.,

D. W. Allan. 1987, 8p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Ultrasonics, Ferroelectrics, and Frequency Control UFFC-34, n6 p647-654 Nov 87.

Keywords: *Clocks, *Time measurement, *Frequency measurement, *Oscillators, Standard deviation, Predictions, Estimating, Reprints, Time domain, Allan variance.

A tutorial review of some time-domain methods of characterizing the performance of precision clocks and oscillators is presented. Characterizing both the systematic and random deviations is considered. The Allan variance and the modified Allan variance are defined, and methods of using them are presented along with ranges and areas of applicability. The standard deviation is contrasted and shown not to be, in general, a good measure for precision clocks and oscillators. Once a proper characterization model has been developed, then optimum estimation and prediction techniques can be employed. Some important cases are illustrated.

801,314

PB88-204920

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Resonances in Electron-Ion Collisions.

Final rept.,

G. H. Dunn. 1987, 19p

Pub. in Proceedings of National Workshop on Atomic and Molecular Physics (6th), Varanasi, India, December 8-13, 1987, p238-256.

Keywords: Elastic scattering, Excitation, *Electron-ion collisions, Dielectronic recombination, Autoionization.

Selected data on electron-ion resonances was examined, with a primary emphasis on the experimental work. New insights have come forth from theory and measurements of dielectronic recombination; mixing of angular momentum states by extrinsic electric fields can act as a 'knob' on the cross section to 'tune' different values. There has also been recent evidence for dielectronic capture followed by double autoionization or auto-double ionization, and some reasonable amount of theory has both preceded and followed this evidence. Dielectronic capture resonances have been predicted on the basis of theory to play a significant role in the excitation of ions by electrons; and though the experimental evidence for the import of these resonances is thus far sketchy, new techniques are being developed at a number of laboratories which should allow detailed study of them.

801,315

PB88-217310

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Construction of an Ellipsoidal Mirror Analyzer for Ion Detection.

Final rept.,

R. Stockbauer, and A. Pararas. 1988, 3p

Sponsored by Office of Naval Research, Arlington, VA. Pub. in Nuclear Instruments and Methods in Physics Research A266, p560-562 1988.

Keywords: *Electrostatic analyzers, Synchrotron radiation, Mirrors, Titanium, Reprints, *Ion detection, Photon stimulated desorption.

An ellipsoidal mirror analyzer (EMA) has been constructed at the National Bureau of Standards for the analysis of ions produced by photon stimulated desorption. This type of analyzer can measure simultaneously differential kinetic energy, angular distribution, and mass. The design of the EMA is similar to one developed previously (D.E. Eastman, J.J. Donelon, N.C. Hien and F.J. Himpsel, Nucl. Instr. and Meth. 172 (1980) 327). However, an entirely new approach has been used in the mechanical design, construction materials, and in the technique for charged particle position detection. The primary differences are an aberration corrected mirror, the use of titanium for the main structural components, and a resistive-anode area detector. A description of these differences and their advantages is given in detail.

801,316

PB88-217435

PC A04/MF A01

National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

NBS (National Bureau of Standards) Measurement Services: Activation Foil Irradiation by Reactor Cavity Fission Sources.

Special pub. (Final),

G. P. Lamaze, and J. A. Grundl. Mar 88, 60p NBS/SP-250/14

Also available from Supt. of Docs. Library of Congress catalog card no. 88-600513.

Keywords: *Dosimetry, Fast neutrons, *Activation foils, *Calibration, Neutron fluence, Fission spectra, USNBS.

The document describes the National Bureau of Standards (NBS) calibration service 44090C (formerly 8.1R) which operates in the following way: (i) dosimetry sensors (metal foils, nuclear track detectors, wires, crystals, etc., supplied by the customer or by NBS) are irradiated to a measured neutron fluence in a fission-spectrum neutron field (for short lived reaction products, the samples are irradiated to near saturation and the fluence rate specified); and (ii) the irradiated dosimetry sensors are shipped to the customer, followed by a test report stating the fluences or fluence rates and associated uncertainties. The scope and philosophy of the service, the neutron field characteristics, irradiation procedures, and the uncertainties in the reported neutron fluences or fluence rates are discussed. Typical maximum fluences are of the order of 3×10^7 to the 15th power neutrons/sq cm, with combined (1 sigma) uncertainties of \pm or \pm 2 %.

801,317

PB88-217443

PC A03/MF A01

National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

PHYSICS

General

NBS (National Bureau of Standards) Measurement Services: Activation Foil Irradiation with Californium Fission Sources.

Special pub. (Final),
G. P. Lamaze, and J. A. Grundl. Mar 88, 42p NBS/SP-250/13
Also available from Supt. of Docs. Library of Congress catalog card no. 88-600508.

Keywords: *Dosimetry, Fast neutrons, *Activation foils, *Calibration, Neutron fluence, Californium 252, US NBS, Fission spectra.

The document describes the NBS calibration service 44080C (formerly 8.10), which operates in the following way: (i) dosimetry sensors (metal foils, nuclear track detectors, wires, crystals, etc., supplied by the customer or by NBS) are irradiated to a certified neutron fluence in a (252)Cf spontaneous fission neutron field (for short lived reaction products, the samples are irradiated to near saturation and the fluence rate specified), and (ii) the irradiated dosimetry sensors are shipped to the customer, followed by a test report stating the fluences or fluence rates and associated uncertainties. The scope and philosophy of the service, the neutron field characteristics, irradiation procedures, and the uncertainties in the reported neutron fluences or fluence rates are discussed. Typical maximum fluences are of the order of 1×10 to the 13th power neutrons/sq cm and maximum fluence rates of 10 million neutrons/cm² sec, with combined (1 sigma) uncertainties of + or - 1.2%.

801,318 PB88-217708

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Area Detectors for X-ray Spectroscopy.

Final rept.,
T. A. Callcott, K. L. Tsang, C. H. Zhang, D. L. Ederer, and E. T. Arakawa. 1988, 8p
Grants NSF-DMR81-14888, NSF-DMR85-03541
See also DE88-001429. Sponsored by National Science Foundation, Washington, DC.
Pub. in Nuclear Instruments and Methods in Physics Research A266, p578-585 1988.

Keywords: *X-ray spectroscopy, Data acquisition, Quantum efficiency, Reprints, *Microchannel electron multipliers, *Si semiconductor detectors, Charge coupled devices, X-ray detection, Soft x radiation, Electron spectroscopy.

Area detectors greatly increase the efficiency of data acquisition in spectroscopic applications. The operating principles, advantages and limitations of two types of detectors system are described. They are the microchannel plate (MCP) with resistive anode readout, and the silicon charged-coupled device (CCD), both with and without MCP enhancement. The linearity, size, resolution, quantum efficiency, noise specifications, stability, and uniformity of response are discussed. Data acquisition electronics are described briefly. The use of the devices is illustrated with applications to electron and soft X-ray spectroscopy.

801,319 PB88-217716

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

Anomalies in Lagrangian Field Theory.

Final rept.,
M. Danos, and L. C. Biedenharn. 1987, 8p
Pub. in Physical Review D 36, n10 p3069-3076, 15 Nov 87.

Keywords: Lagrangian functions, Positronium, Reprints, *Lagrangian field theory, Multi-photon processes, Feynman path integral.

The authors investigate the manner in which anomalies enter the description of experimental data by means of effective Lagrangians, with particular attention to the known result that delta-function-type contact singularities of Feynman integrals do not contribute to the S matrix. The development uses the two-photon decay of singlet positronium as an example. It is shown that the anomaly becomes essential on replacing positronium effectively by a point particle; the anomaly arises automatically in the resulting effective Lagrangian as a remnant of the underlying QED structure of positronium.

801,320 PB88-225693

PC A03/MF A01
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Effect of a Large Rotating Scatterer in a Rectangular Cavity.

Technical note (Final),
D. I. Wu, and D. C. Chang. Mar 88, 41p NBS/TN-1317

Also available from Supt. of Docs as SN003-003-2869-0. Prepared in cooperation with Colorado Univ. at Boulder.

Keywords: *Anechoic chambers, *Cavity resonators, *Stirrers, Perturbation, Electromagnetic fields, Electromagnetic interference, Frequency shift, Frequency modulation, Transmission-Line-Matrix method.

In a mode-stirred chamber, the field in the cavity is perturbed with a stirrer or rotating scatterer so that the time-averaged field is constant. The report examines the fundamental properties associated with a perturbing body in a cavity and finds that the key to effective field perturbation lies in shifting the eigenmode frequencies. The shifting may be large enough that the new perturbed modes no longer resemble the original unperturbed modes. In effect, as the body rotates, different perturbed modes may be excited, thus introducing randomness into the system. Using the Transmission-Line-Matrix (TLM) method, the shifting of eigenfrequencies and the variation on the magnitude of the fields for different stirrer sizes are computed.

801,321 PB88-230339

Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Ballistic Methods of Measuring g--the Direct Free-Fall and Symmetrical Rise-and-Fall Methods Compared.

Final rept.,
J. E. Faller, and I. Marson. 1988, 7p
Pub. in Metrologia 25, p49-55 1988.

Keywords: *Gravity, Measurement, Precision, Accuracy, Reprints, Free fall.

Ballistic methods of measuring the absolute value of the free-fall acceleration g are discussed. Particular attention is given to various error sources and measurement limitations which affect the accuracy obtainable in the measurement.

801,322 PB88-230495

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Performance of the SURF-II High-Throughput Toroidal Grating Monochromator.

Final rept.,
R. L. Kurtz, D. L. Ederer, J. Barth, and R. Stockbauer. 1988, 5p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in Nuclear Instruments and Methods in Physics Research A266, p425-429 1988.

Keywords: *Monochromators, Reprints, *SURF II storage ring, Photon stimulated desorption.

The performance of the 'high-flux' toroidal grating monochromator (HFTGM) at the NBS SURF-II synchrotron storage ring is assessed. Two gratings are studied: one with a ruled profile and the other having a laminar profile. The laminar profile is shown to reduce substantially the intensity of higher-order diffracted light with only a small decrease in the intensity of the first order light. The dependence of the energy resolution as a function of the area of the grating illuminated is also discussed.

801,323 PB88-237391

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Autoionisation of N(5+)(31n'l') for n'=3-10: Experiment and Theory.

Final rept.,
D. H. Oza, P. Benoit-Cattin, A. Bordenave-Montesquieu, M. Boudjema, and A. Gleizes. 1988, 7p
Pub. in Jnl. of Physics B: At. Mol. Opt. Phys. 21, pL131-L137 1988.

Keywords: Reprints, *Nitrogen ions, *Autoionization, Charge exchange, Electron spectra, Ion-atom collisions, Ion-molecule collisions.

The energy values of the autoionization states (31n'l') of the N(5+) ion are deduced from the analysis of ejected-electron spectra following the collisional electron charge transfer process between bare N(7+) pro-

jectiles and various targets (He, H2 and Ar). The authors compare these results with their ab initio theoretical calculations employing a fourteen-state pseudostate close-coupling scheme.

801,324 PB88-237409

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

3p(6)3d(8)-3p(5)3d(9) Transitions in Ironlike Ions from Ru(18+) to Gd(38+).

Final rept.,
J. O. Ekberg, U. Feldman, and J. Reader. 1988, 10p
Sponsored by Department of Energy, Washington, DC. Office of Magnetic Fusion Energy, and Strategic Defense Initiative Organization, Washington, DC.
Pub. in Jnl. of the Optical Society of America B 5, n6 p1275-1284 Jun 88.

Keywords: *Electron transitions, Atomic energy levels, Far ultraviolet radiation, Reprints, Laser-produced plasma, Isoelectric sequence.

Spectra of 14 Fe-like ions from Ru(18+) to Gd(38+) were observed with laser-produced plasmas and grazing-incidence spectrographs. The wavelengths range from 26 to 78 A. Line identifications were made for transitions of the 3p(6)3d(8)-3p(5)3d(9) array. The number of identifications varied from 42 in Ru(18+) to 10 in Gd(38+). Experimental values for many of the energy levels of the 3p(6)3d(8) and 3p(5)3d(9) configurations were derived from the measured wavelengths. Predicted values for missing levels and for ions not observed in the isoelectronic sequence were obtained from parametric fits of the differences between the observed level values and relativistically calculated level values. Results are given for all ions of the sequence from Ru(18+) to Yb(44+). Wavelengths for magnetic dipole transitions within the 3p(6)3d(8) configuration calculated from the energy levels are given for several ions.

801,325 PB88-238530

Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Cavitation Characteristics of a Small Centrifugal Pump in He I and He II.

Final rept.,
P. R. Ludtke, and D. E. Daney. 1988, 5p
Pub. in Cryogenics 28, p96-100 Feb 88.

Keywords: *Centrifugal pumps, *Cavitation, Liquid helium, Reprints, *Cryogenic equipment, Spacecraft equipment.

The cavitation characteristics of a small pre-induced centrifugal pump operating in He I and He II over the temperature range 1.8-4.2 K are presented. The pump and close-coupled induction motor operate immersed in liquid helium. A six-blade propeller inducer and a three-blade screw inducer were both tested. With this pump configuration using either inducer, there is a tremendous difference between the cavitation characteristics of He I and He II. The NPSH requirements for this pump with the screw inducer could not be determined for He I but it is less than -100 mm and, depending on flow rate, ranges between 35 and 165 mm for He II.

801,326 PB88-238555

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.

Injection Chicane of the NBS (National Bureau of Standards)-Los Alamos Racetrack Microtron.

Final rept.,
P. H. Debenham, S. S. Bruce, S. Penner, and M. A. D. Wilson. 1987, 33p
Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Particle Accelerator Conference, Washington, DC., March 16-19, 1987, p1452-1454.

Keywords: *Electron accelerators, *Racetrack microtrons, *Electron beam injection, *Microtrons.

Injection of 5 MeV electrons into the NBS-Los Alamos racetrack microtron is accomplished with a dipole magnet on the linac axis. A three-magnet chicane is used to compensate for the unwanted deflection of recirculating beam by the injection magnet. In order to minimize emittance growth due to power supply noise, the three chicane magnets are driven by two power supplies, with each supply connected in series to two

coils in different magnets. The arrangement, together with the tight space available for the chicane, constrains the choice of conductors, and leads to very precise and compact low-field magnets. Magnetic field measurements demonstrate that all design goals have been achieved.

801,327

PB88-238563

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.

Performance of the High Power RF System of the NBS (National Bureau of Standards)-Los Alamos Racetrack Microtron.

Final rept.,

R. I. Cutler, and L. Young. 1987, 3p

Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Particle Accelerator Conference, Washington, DC., March 16-19, 1987, p1863-1865.

Keywords: *Electron accelerators, Linear accelerators, Continuous radiation, *Racetrack microtrons, *Microtrons, *RF systems, Computerized control systems.

The high power RF system for the NBS-LANL Racetrack Microtron (RTM) consists of four CW linac sections powered by a single 500 kW CW klystron at 2380 MHz. The power level and phase in each linac section is regulated by a feedback network that controls high power waveguide power dividers and phase shifters as well as the RF klystron drive. A block diagram of the system is shown. The desired RF power and phase levels in each section are set by the RTM computer control system. Application programs within the RTM control computer allow fast power-up of all four linac sections under computer control. These programs, which monitor forward power, reverse power, and vacuum in each section, also significantly shorten the time needed to RF process a linac section after a vacuum pump down.

801,328

PB88-238571

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.

Performance of Wire Scanner Beam Profile Monitors to Determine the Emittance and Position of High Power CW Electron Beams of the NBS (National Bureau of Standards)-Los Alamos Racetrack.

Final rept.,

R. I. Cutler, J. Owen, and J. Whittaker. 1987, 3p

Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Particle Accelerator Conference, Washington, DC., March 16-19, 1987, p625-627 1988.

Keywords: *Electron accelerators, Electron beams, Emittance, *Racetrack microtrons, *Beam monitors, *Microtrons.

The NBS-LANL Race Track Microtron (RTM) injector produces a sub-millimeter diameter, 600 micro A, 5 MeV CW electron beam. In order to steer and focus the electron beam and to measure its emittance and energy spread, a system of wire scanner beam profile monitors has been developed. Three wire scanners are mounted in a straight line with approximately one meter spacing for emittance measurements. The fourth wire scanner is positioned after a 45 degree bending magnet for energy spread measurements.

801,329

PB88-238597

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.

Performance of the 5 MeV Injector for the NBS (National Bureau of Standards)-Los Alamos Racetrack Microtron.

Final rept.,

M. A. Wilson, R. L. Ayres, R. I. Cutler, P. H.

Debenham, E. R. Lindstrom, D. L. Mohr, S. Penner,

J. Rose, L. M. Young, and J. Stovall. 1987, 3p

Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Particle Accelerator Conference, Washington, DC., March 16-19, 1987, p322-324.

Keywords: *Electron accelerators, *Injectors, Radio frequencies, Emittance, Performance, *Racetrack microtrons, *Microtrons, *Beam injection, MeV range 01-100.

The NBS-Los Alamos racetrack microtron (RTM) injector consists of a 100 keV chopper/buncher system and a 5 MeV, 2-section, side-coupled, continuous wave RF linac operating in a standing-wave mode at 2380 MHz. The purpose of the injector is to provide a low-emittance electron beam of up to 550 micro A CW current, with a suitably small phase and energy spread for insertion into the RTM.

801,330

PB88-238605

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.

Orbit Reversing Magnets for the NBS (National Bureau of Standards)-Los Alamos Racetrack Microtron.

Final rept.,

M. A. Wilson, P. H. Debenham, S. Penner, and S. S.

Bruce. 1987, 3p

Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Particle Accelerator Conference, Washington, DC., March 16-19, 1987, p1469-1471.

Keywords: *Electron accelerators, Electron beams, Electromagnets, Deflection, Performance, Design, *Racetrack microtrons, *Microtrons, *Beam bending magnets, MeV range 10-100.

In the NBS-Los Alamos racetrack microtron (RTM), the 17 MeV electron beam, which has made one pass through the RTM linac, is deflected 180 deg in one end magnet and is returned to the same end of the (standing wave) linac for a second pass. A pair of dipole magnets on the linac axis compensate for the beam displacement caused by the end magnet so that the beam enters the linac on axis. These two magnets are designed to have equal field integrals in order to produce a pure displacement. Matching the field integrals was complicated by the quite different widths of the two magnets which have different beam clearance requirements. In addition, the wider magnet contains a quadrupole coil for beam steering. Design considerations are presented. Magnetic field measurements show that critical design goals have been achieved.

801,331

PB88-238654

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

PIN Diode Detectors for Synchrotron X-rays.

Final rept.,

J. P. Kirkland, T. Jach, R. A. Neiser, and C. E.

Bouldin. 1988, 6p

Grant N00015-85-C-2628

Sponsored by Naval Research Lab., Washington, DC. Pub. in Nuclear Instruments and Methods in Physics Research A266, p602-607 1988.

Keywords: Synchrotron radiation, Reprints, *X-ray detection, *PIN diodes.

PIN diodes offer a number of advantages over ion chambers and other X-ray detectors in size, signal-to-noise ratio, collection efficiency, dynamic range, and ultrahigh vacuum compatibility. The authors have measured the response of several commercially available PIN diodes in the X-ray region of 3.5-11 keV on the Naval Research Laboratory's Materials Analysis Beam Line (X-23B) at the National Synchrotron Light Source. They analyze the results of these measurements with respect to the construction of these devices, and discuss various synchrotron applications.

801,332

PB88-238696

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Frequency Response Study of Packed Bed Heat Transfer at Elevated Temperatures.

Final rept. 1 Apr 81-1 Jan 85,

M. L. Huber, and M. C. Jones. 1988, 11p

Contract DE-AC01-81ER10823

Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.

Pub. in International Jnl. of Heat Mass Transfer 31, n4 p843-853 1988.

Keywords: *Heat transfer, Frequency response, Aluminum oxide, Spheres, Mathematical models, Convection, Reprints, *Packed bed, Parameter estimation.

Interphase heat transfer coefficients and effective axial conductivities were obtained for packed beds of uniform alumina spheres with gaseous throughflow in

the temperature range 375-1300 K. The method used was parameter estimation from frequency response measurements at two axial locations in a bed when a small sinusoidal temperature disturbance was imparted to the inlet gas temperature. A new model was proposed and frequency response expressions derived in order to take into account the large effective axial conductivity resulting from radiative transfer, unsteady temperature distribution in the solid, and gas-solid interphase heat transfer. A key feature of the model is the use of the local average particle surface temperature as the dependent variable.

801,333

PB88-238753

Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Spectra of Copperlike and Zinclike Xenon: Xe XXV and Xe XXVI.

Final rept.,

V. Kaufman, J. Sugar, and W. L. Rowan. 1988, 2p

Sponsored by Department of Energy, Washington, DC. Pub. in Jnl. of the Optical Society of America B 5, n6 p1273-1274 Jun 88.

Keywords: *Atomic spectra, Atomic energy levels, Gas ionization, Reprints, *Xenon ions, Isoelectronic sequence, Tokamak devices, Plasma.

The spectra of highly ionized xenon were generated in a tokamak plasma and photographed in the region 60-350 A with a 2.2-m grazing-incidence spectrograph. The 4s(2)-4s4p transitions of Zn-like xenon (XeXXV) and the 4l-4l(+1) transitions of Cu-like xenon (XeXXVI) were measured with estimated uncertainties of + or - 0.005 A. These measurements have been combined with previous wavelength measurements of Xe XXVI to determine energy levels. A value for the ionization energy of Xe(25+) of 6,912,400 + or - 3000/cm (857.0 + or - 0.4 eV) was derived.

801,334

PB88-242060

PC A07/MF A01
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Automated High-Temperature Guarded-Hot-Plate Apparatus for Measuring Apparent Thermal Conductivity.

J. G. Hust, B. J. Filla, J. A. Hurley, and D. R. Smith.

May 88, 132p NBSIR-88/3089

Sponsored by Oak Ridge National Lab., TN.

Keywords: *Temperature measuring instruments, *Thermal conductivity, High temperature tests, Automatic control, Thermal insulation, Thermocouples.

An automated guarded-hot-plate apparatus was designed and built to meet the requirements of ASTM Standard Test Method C-177 for measuring the thermal conductance of thermal insulation. Apparent thermal conductivity has been measured with this apparatus in the range from 40 to 100 mW/(m.K) at mean temperatures from 300 to 750 K, in environments of air and helium, at pressures ranging from atmospheric pressure to roughing-pump vacuum. The apparatus is controlled by a desk-top computer. A thermocouple device of novel design more accurately senses the average temperature over the surface of each heater plate. An improved algorithm for the control sequence leads to more stable heater powers and specimen temperatures. Overall uncertainties of apparent thermal conductivities at atmospheric pressure are 2 percent at 300 K and 5 percent at 750 K when measuring conductivities in the range from 40 to 100 mW/(m.K). The apparatus will be valuable in development of new Standard Reference Materials of low conductivity and for higher temperature ranges, and is being used in comparative interlaboratory measurement programs.

801,335

PB89-101323

Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Shell-Structure Phase of Magnetically Confined Strongly Coupled Plasmas.

Final rept.,

S. L. Gilbert, J. J. Bollinger, and D. J. Wineland.

1988, 4p

Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Arlington, VA.

Pub. in Physical Review Letters 60, n20 p2022-2025, 16 May 88.

PHYSICS

General

Keywords: Shells(Structural forms), Reprints, *Beryllium plasma, Beryllium 9, Penning traps, Laser cooling, Concentric shells, Ion traps.

The authors report the observation of shell structure in $(9\text{Be}(1+))$ nonneutral plasmas (ion clouds) confined in a Penning trap. Clouds containing up to 15,000 ions (density about 100 million/cc) were laser cooled to temperatures of about 10 mK. Under these conditions, the ions are strongly coupled and exhibit liquidlike and solidlike behavior through the formation of concentric shells. The shells were observed by direct imaging of the laser-induced ion fluorescence for values of the Coulomb coupling constant Γ ranging from about 20 to 200. The shell structure is compared with theoretical predictions.

801,336
PB89-101349 Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Time and Frequency Div.
Photon Antibunching and Sub-Poissonian Statistics from Quantum Jumps in One and Two Atoms.
Final rept.,
W. M. Itano, J. C. Bergquist, and D. J. Wineland.
1988, 4p
Sponsored by Air Force Office of Scientific Research, Arlington, VA., and Office of Naval Research, Arlington, VA.
Pub. in Physical Review A 38, n1 p559-562, 1 Jul 88.

Keywords: Intermediate infrared radiation, Electron transitions, Reprints, *Mercury ions, *Ion storage, Laser induced fluorescence, Quantum optics, Laser spectroscopy, Photon emission.

Antibunching and sub-Poissonian statistics of the 11-micrometer photon emission from the $5d(10)6p$ doublet $P(1/2)$ to $5d(9)6s(2)$ doublet $D(3/2)$ transition in one and two trapped $\text{Hg}(1+)$ ions have been inferred from the quantum jumps of the laser-induced fluorescence of the first resonance transition at 194 nm. Each downward step in fluorescence was assumed to mark the emission of an 11-micrometer photon. Signals from two ions were consistent with the assumption that quantum jumps in the two ions occurred independently. Mandel's Q parameter was determined to be approximately -0.25 for one and two ions.

801,337
PB89-101364 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Effects of Configuration Mixing in M1 and E2 Transitions between Ground-State Terms of Sulfurlike Ions.
Final rept.,
F. B. Saloman, and Y. K. Kim. 1988, 7p
Pub. in Physical Review A 38, n2 p577-583, 15 Jul 88.

Keywords: Ground state, Reprints, *M1-transitions, *E2-transitions, Isoelectronic sequence, *Multi-charged ions, Forbidden transitions, Configuration mixing.

Magnetic-dipole and electric-quadrupole transition rates for S-like ions between ground-state terms have been calculated using multiconfiguration Dirac-Fock wave functions. Sudden changes were found in these transition rates from one element to the next where there is a change of the dominant configuration. Also, ordering of the levels changes as the nuclear charge increases, but this is not necessarily reflected as a sudden change in transition rates. The results demonstrate the necessity of using multiconfiguration calculations in the study of the systematics of transition rates along isoelectronic sequences.

801,338
PB89-101406 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Electron-Impact Excitation and Recombination into Excited States of Lithiumlike Ions.
Final rept.,
R. U. Datla, and H. J. Kunze. 1988, 6p
Pub. in Physical Review A 37, n12 p4614-4619, 15 Jun 88.

Keywords: Electron irradiation, Excitation, Reprints, *Multicharged ions, *Electron-ion collisions, Nitrogen ions, Oxygen ions, Excited states, Recombination, EV range 10-100, Plasma.

Relative excitation rate coefficients of N v and O vi are measured using a well-diagnosed Theta-pinch plasma.

Levels of $n=4$ and 5 are included in the measurements for the first time. Experimental values are in satisfactory agreement with theoretical values. A method to deduce the recombination rate coefficient from the He-like ions is suggested from the observations of the effect of recombination on transitions originating from levels of principal quantum number $n=4$ and 5. Recombination rates of about 10 to the -12th power cc/s at 69 eV for N v and about 10 to the -13th power cc/s at 40 eV for O vi are deduced. These rates are larger than the known theoretical rates for radiative, three-body, and dielectronic recombination; charge exchange with hydrogen is suggested as possible explanation.

801,339
PB89-107106 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Radiation Field from a Rectangular Plaque Source: Critique of Some Engineering Approximations.
Final rept.,
A. M. Ghose, D. A. Bradley, and J. H. Hubbell. 1988, 7p
Pub. in Applied Radiation and Isotopes 39, n5 p421-427 1988.

Keywords: *Atomic physics, *Radiation measuring instruments, *Radiation sources, Approximation, Radiation monitoring, Reprints, *Radiation fields.

Geometry-dependent effects upon the response of an omnidirectional detector and rectangular source configuration are reviewed. A survey of approximation is conducted and evaluation of regions of validity performed. A variant of the Wallace approximation is shown to produce values that do not vary from 'exact' calculations by more than plus or minus 5 percent, often yielding results that are within plus or minus 1 percent.

801,340
PB89-107163 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electric Dipole Moment of the Neutron.
Final rept.,
N. F. Ramsey. 1988, 4p
Pub. in Physica Scripta T22, p140-143 1988.

Keywords: *Neutrons, Parity, Reprints, *Electric dipole moments, Kaons neutral long-lived, T invariance, Ultracold neutrons.

If there is either time reversal (T) or parity symmetry (P), there can be no electric dipole moment for particles whose orientations are fully specified by the orientations of their spin angular momenta. As a result, there have been extensive searches for electric dipole moments of particles as tests of these symmetries. The history of the searches for a neutron electric dipole moment is briefly summarized. The most sensitive current experiments use ultra cold neutrons stored in bottles whose walls totally reflect the neutrons. These experiments are described and the current results are given. The results are compared with the predictions of theories that account for the known CP non-conservation in the decay of the Kaons neutral sub L.

801,341
PB89-107171 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Resonances in Electron-Impact Single, Double, and Triple Ionization of Heavy Metal Ions.
Final rept.,
A. Muller, K. Tinschert, G. Hofmann, E. Salzborn, and G. H. Dunn. 1988, 4p
Sponsored by North Atlantic Treaty Organization, Brussels (Belgium).
Pub. in Physical Review Letters 61, n1 p70-73, 4 Jul 88.

Keywords: *Ionization, Resonance, Reprints, *Electron-ion collisions, Autoionization, Colliding beams, Heavy ions.

The authors report narrow dielectronic-capture resonances decaying by double autoionization, observed for the first time in electron-impact ionization of ions. They also observe corresponding peaks in double and triple ionization, leading them to postulate new processes where dielectronic capture is followed by triple or quadruple autoionization, respectively.

801,342
PB89-107189 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron-Impact Excitation of the Resonance Transition in Be(1+).
Final rept.,
J. Mitroy, and D. W. Norcross. 1988, 10p
Contract DOE-EA-77-C-01-6010
See also PB87-165684. Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Physical Review A 37, n10 p3755-3764, 15 May 88.

Keywords: Electron irradiation, Excitation, Cross sections, Electron scattering, Reprints, *Beryllium ions, *Electron-ion collisions, Excited states.

The cross section for electron-impact excitation of the resonance transition $(2s-2p)$ of $\text{Be}(1+)$ has been calculated in a variety of models at low incident-electron energies. Both five-state $(2s,2p,3s,3p,3d)$ and nine-state close-coupling (with and without polarization potentials) calculations have been completed. The results, while in good agreement with previous calculations, do not resolve all the long-standing discrepancies between theory and experiment. There are still significant discrepancies with the experimental cross section for the $2s-2p$ transition. However, previous calculations of the polarization of the resonance fluorescence used an expression for the scattering amplitude that was inappropriate for ions. The present results for the polarization use the correct expression, and are in good agreement with experiment. Calculations using the same approach for other quantities, specifically binding energies and resonance parameters, show small but significant improvements when compared with experiment.

801,343
PB89-107213 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Spin-Exchange Cross Section for Electron Excitation of Na 3s-3p Determined by a Novel Spectroscopic Technique.
Final rept.,
X. L. Han, G. W. Schinn, and A. Gallagher. 1988, 4p
Contract DE-AC02-84ER13171
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Physical Review A 38, n1 p535-538, 1 Jul 88.

Keywords: Experimental design, Excitation, Cross sections, Electron spin, Reprints, *Sodium atoms, *Electron-atom collisions, Excited states, Exchange interactions, Orbital angular momentum.

An experimental technique is described which enables determination of the partial cross sections for electron excitation of atoms as a function of changes in spin and orbital angular momentum. The method provides a good signal-to-noise ratio in the energy region near threshold, and could be used to study long- or short-lived excited states of many atomic systems. Measurements for Na 3S-3P, near-threshold excitation are reported here. The results are generally in good agreement with the close-coupling calculations of D. L. Moores and D. W. Norcross (J. Phys. B 5, 1482 (1972)) for the largest delta m sub S and delta m sub L components of the cross section, but not for the component with absolute value of delta m sub S = 1 and absolute value of delta m sub L = 1, indicating that the exchange interaction is larger than previously recognized.

801,344
PB89-114045 PC A04/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Center for Building Technology.
Algorithms for Calculating Radiation View Factors between Plane Convex Polygons with Obstructions.
G. N. Walton. Oct 86, 67p NBSIR-86/3463

Keywords: *Thermal radiation, Algorithms, Blocking, Computer programs, Performance tests, Comparison, Graphs(Charts), *Radiative heat transfer, *View effects.

The report describes several developments in the calculation of radiation view factors between plane convex surfaces. Gaussian integration is shown to greatly improve the line integral methods for comput-

ing unobstructed view factors. Calculation techniques from computer graphics are found to be helpful when the view between surfaces is partially obstructed by other surfaces. A hierarchy of tests is developed to eliminate non-obstructing surfaces in an efficient manner. A technique of projecting the shadows of obstructing surfaces is developed for computing the obstructed view factors. It is shown that the new algorithm is more accurate and generally faster than the algorithm in another modern program.

801,345
PB89-118814 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Dependence of the Half Widths of Plasma-Broadened Hydrogen Lines on Reduced Mass, Temperature, and Density.

Final rept.,
D. H. Oza, R. L. Greene, and D. E. Kelleher. 1988, 8p
Grant NSF-PHY85-19371
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and National Science Foundation, Washington, DC.
Pub. in Physical Review A 38, n5 p2544-2551, 1 Sep 88.

Keywords: *Hydrogen, Line spectra, Stark effect, Plasmas(Physics), Mass, Electron density(Concentration), Reprints, *Line broadening, Temperature dependence.

Using a relaxation theory of ion broadening, the authors have performed calculations for $L_{\text{sup } a}$, $P_{\text{sup } a}$, $H_{\text{sup } a}$, and $L(\gamma)$ for neutral hydrogen radiators. The calculations span a wide range of electron density, temperature, and μ , the reduced mass of the radiator and ion perturber. Four regions of qualitatively different influence of ion motion on the half widths at half maximum of hydrogenic line profiles are identified. At sufficiently small μ the ion dynamics are impact in nature, while at very large μ they are quasistatic. The half width increases with μ in the impact region, and decreases with μ as the quasistatic region is approached. In between these latter two regions, the half width reaches a maximum. A similar dependence of the reduced width is observed as a function of the plasma density. The temperature dependence is discussed as well. The ion dynamic influence on the half width is determined by the ratio of the relevant collision duration to the collisional coherence time for the transition. Validity criteria for the ion-impact and quasistatic limits are desired.

801,346
PB89-118855 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Modeling Single Arm Electron Scattering and Neutron Production from Nuclei by GeV Electrons.
Final rept.,
J. W. Lightbody, and J. S. O'Connell. 1988, 8p
Pub. in Computers in Physics, p57-64 May/Jun 88.

Keywords: *Photoproduction, *Electron scattering, Inelastic scattering, Bremsstrahlung, Differential cross sections, Mathematical models, Reprints, *Electroproduction, MeV range 100-1000, GeV range 01-10.

Nuclear reaction data for the doubly differential cross sections of inelastic electron scattering and of electronuclear and electronuclear production are parameterized by analytic models of the major reaction mechanisms. Predictive FORTRAN codes for the yields of reaction products have been developed for all nuclei interacting with electrons and bremsstrahlung beams in the energy range 0.5 - 5 GeV. Comparison with variety of electromagnetic reaction data is shown.

801,347
PB89-122386 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Scattering of Polarized Photons by Protons, L. C. Maximon. Oct 88, 20p NISTIR-88/3877

Keywords: *Electromagnetic interactions, *Compton effect, *Magnetic dipoles, *Photon-proton interactions, *Electric dipole moments.

The author derived the differential cross section for the scattering of plane polarized photons by protons below pion threshold. The contribution from the charge, spin, and anomalous magnetic moment are calculated with no approximation in the photon energy, ϵ . The

contribution from the proton structure is included only to lowest order (viz., $O((\epsilon/m)^2)$), and comes from the electric and magnetic dipole polarizabilities.

801,348
PB89-123210 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
CAMAC Handler for RT-11.
Final rept.,
R. D. Spal. 1988, 5p
Pub. in Nuclear Instruments and Methods in Physics Research A270, p462-466 1988.

Keywords: Data acquisition, Microcomputers, Reprints, *CAMAC system, RT-11 operating system, Computer applications.

A CAMAC handler for the RT-11 extended memory monitor is described. It permits CAMAC programs to run as virtual jobs, thus exploiting the full power of the extended memory monitor. For example, two CAMAC programs, each using its maximum 32K word virtual address space, may run in foreground/background mode. A LAM synchronized and terminated general multiple action is introduced to minimize the operating system overhead.

801,349
PB89-123277 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Incident-Energy Dependence of Electron-Ion Collision Cross Sections.
Final rept.,
Y. K. Kim, and J. P. Desclaux. 1988, 4p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy, and North Atlantic Treaty Organization, Brussels (Belgium).
Pub. in Physical Review A 38, n4 p1805-1808, 15 Aug 88.

Keywords: *Collision cross sections, Excitation, Reprints, *Electron-ion collisions, Energy dependence, Iron ions, Multicharged ions, Atomic excitations, Forbidden transitions.

It is shown that the dependence of electron-impact cross sections sigma for the excitation of ions on the incident energy T can be represented by compact expressions for a wide range of T from thresholds to 10 keV. These expressions are $\sigma(T) = A \ln T + B + C/T + D \ln T/T$ for dipole- and spin-allowed transitions, $\sigma(T) = A + B/T + C/(T^2) + D/(T^3)$ for dipole-forbidden but spin-allowed transitions, and $\sigma(T) = (A+BT)/(1+CT+D(T^2))$ for spin-forbidden transitions, where A, B, C, and D are constants that depend on target properties but not on T. These formulas should provide accurate cross sections in applications where many atomic cross sections are needed. Examples are presented for the excitations of Be-like Fe(22+) ion by electron impact.

801,350
PB89-123731 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Effect of Closed Classical Orbits on Quantum Spectra: Ionization Atoms in a Magnetic Field. 1. Physical Picture and Calculations.

Final rept.,
M. L. Du, and J. B. Delos. 1988, 17p
See also PB87-223764 and PB89-123749. Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review A 38, n4 p1896-1912, 15 Aug 88.

Keywords: *Absorption spectra, Magnetic fields, Atoms, Reprints, *Photoionization.

Two papers developed the theory of oscillatory spectra. When an atom is placed in a magnetic field, and the absorption spectrum into states close to the ionization threshold is measured at finite resolution, so that individual energy levels are not resolved, it is found that the absorption as a function of energy is a superposition of sinusoidal oscillations. The papers present a quantitative theory of this phenomenon. In the first paper, the authors describe the physical ideas underlying the theory in the simplest possible way, and they present their first calculations based upon the theory. In the second paper, the theory is developed in full detail, proofs of all of the assertions are given, and the authors describe the algorithm that was used to make the calculations.

801,351

PB89-123749 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Effect of Closed Classical Orbits on Quantum Spectra: Ionization of Atoms in a Magnetic Field. 2. Derivation of Formulas.

Final rept.,
M. L. Du, and J. B. Delos. 1988, 18p
See also PB89-123731.
Pub. in Physical Review A 38, n4 p1913-1930, 15 Aug 88.

Keywords: *Absorption spectra, Magnetic fields, Approximation, Atoms, Algorithms, Reprints, *Photoionization.

A formula is derived for oscillations in the near-threshold absorption spectrum of an atom in a magnetic field. Three approximations are used. (1) Near the atomic nucleus, the diamagnetic field is negligible. (2) Far from the nucleus, the waves propagate semiclassically. (3) Returning waves are similar to (cylindrically modified) Coulomb-scattering waves. With use of these approximations, together with the physical picture described in the accompanying paper, an algorithm is specified for calculation of the spectrum.

801,352
PB89-123764 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Crossed-Beam Studies of Associative Ionization in Heteronuclear Systems: NaLi(1+) Production from Li* + Na and Na* + Li Collisions.

Final rept.,
B. C. Johnson, M. X. Wang, and J. Weiner. 1988, 9p
Sponsored by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Jnl. of Physics B: At. Mol. Opt. Phys. 21, p2599-2607 1988.

Keywords: Reprints, *Atom-atom collisions, *Ionization coefficients, *Lithium atoms, *Sodium atoms, Heteronuclear systems, Crossed beams.

Direct measurements are reported of crossed-beam reaction rate coefficients for the production of NaLi(1+) from associative ionization collisions between Na and Li atoms. Separate excitation of the np levels in each atomic species permits two series of experiments: Li*(np) + Na yields NaLi(1+)+c, 4 = or less than n = or less than 9; Li+Na*(np) yields NaLi(1+)+e, 8 = or less than n = less than 14. Ion production rates of NaLi(1+) arising from interbeam collision were normalized to Na2(1+) and Li2(1+) production rates arising from interbeam associative ionization. Comparison of these results with both quantitative and qualitative theoretical prediction reveals significant disagreement.

801,353
PB89-123848 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Atomic Transitions in Finite-Bandwidth Squeezed Light.
Final rept.,
H. Ritsch, and P. Zoller. 1988, 4p
Pub. in Physical Review Letters 61, n9 p1097-1100, 29 Aug 88.

Keywords: *Electron transitions, Absorption spectra, Line width, Stochastic processes, Reprints, Density matrix, Bloch equations, Squeezed light.

A stochastic density-matrix equation for an atom strongly driven by finite-bandwidth squeezed light is derived. The quantum properties of the light are accounted for by a doubling of dimensions of the stochastic process for c-number electric field amplitudes. The possibility of obtaining reduced atomic linewidths in the absorption spectrum of the atom embedded in colored squeezed light is discussed, based on nonperturbative solutions of stochastic optical Bloch equations.

801,354
PB89-124861 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

PHYSICS

General

Accurate Acoustic Thermometry I: The Triple Point of Gallium.

Final rept.,
M. R. Moldover, and J. P. M. Trusler. 1988, 23p
Pub. in Metrologia 26, p165-187 1988.

Keywords: *Gallium, *Argon, Acoustic velocity, Thermodynamics, Water, Acoustic resonators, Reprints, *Triple point, *Acoustic thermometry, Pressure dependence.

The speed of sound in argon has been accurately measured in the pressure range 25-380 kPa at the temperature of the triple point of gallium (T sub g) and at 340 kPa at the temperature of the triple point of water (T sub t). The results are combined with previously published thermodynamic and transport property data to obtain (T sub g)=(302.9169 plus or minus 0.0005) K on the thermodynamic scale. Among recent determinations of T(68) (the temperature on IPTS-68) at the gallium triple point, those with the smallest measurement uncertainty fall in the range 302.923 71 to 302.923 98K. The authors conclude that T-T(68)=(-6.9 plus or minus 0.5) mK near 303 K, in agreement with results obtained from other primary thermometers.

801.355
PB89-126346 Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Static Properties of a Non-Neutral (9)Be(1+) Ion Plasma.

Final rept.,
L. R. Brewer, J. D. Prestage, J. J. Bollinger, W. M. Itano, D. J. Larson, and D. J. Wineland. 1988, 15p
Sponsored by Office of Naval Research, Arlington, VA., Air Force Office of Scientific Research, Bolling AFB, DC., and National Science Foundation, Washington, DC.
Pub. in Physical Review A 38, n2 p859-873, 15 Jul 88.

Keywords: Reprints, *Beryllium ions, *Ion traps, Laser cooling, Penning traps, Beryllium 9, Mercury 198, Ion plasmas.

The authors report measurements of the static properties of laser-cooled non-neutral (9)Be(1+)-ion plasmas stored in Penning traps under a variety of experimental conditions. The authors have measured the shape, rotation frequency, density, and temperature of the ions as functions of the Penning-trap potential and laser-cooling configuration. Two different traps were used. In one trap, the authors were able to measure the ion temperature in directions both perpendicular and parallel to the trap magnetic field. In the other trap, (198)Hg(1+) ions were stored simultaneously with the (9)Be(1+) ions, and their effect on the (9)Be(1+) ions was measured. The experimental measurements are compared with theoretical predictions.

801.356
PB89-126395 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.

160TbTb(sc): A New Absolute Nuclear Orientation Thermometer for Use in High Magnetic Fields.

Final rept.,
H. Marshak, W. D. Brewer, P. Roman, and M. Boettcher. 1987, 2p
Pub. in Japanese Jnl. of Applied Physics 26, Supplement 26-3, p1737-1738 1987.

Keywords: *Temperature measurement, Nuclear magnetic resonance, Single crystals, Reprints, *Thermometers, *Terbium 160, Oriented nuclei, Double resonance methods, High magnetic fields, Low temperature.

The authors have studied the rare earth system consisting of radioactive (160)Tb in ferromagnetic terbium single crystal, in order to develop it as an absolute nuclear orientation thermometer for use at low temperatures and in high magnetic fields.

801.357
PB89-126403 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.

Nuclear Double Resonance of Tb: (160)Tb Oriented at Low Temperatures.

Final rept.,
H. Marshak, W. D. Brewer, P. Roman, E. Klein, and K. Freitag. 1987, 4p
Pub. in Physical Review Letters 59, n15 p1764-1767, 12 Oct 87.

Keywords: *Nuclear magnetic resonance, Nuclear magnetic moments, Single crystals, Reprints, *Terbium 160, Double resonance methods, Nuclear electric moments, Quadrupole moments, Oriented nuclei, Magnetic dipole moments.

The authors report the first simultaneous observation of two of the quadrupole-split components of the nuclear magnetic resonance in oriented nuclei. Perturbation of the gamma-ray anisotropy from 72-d (160)Tb implanted and oriented at low temperatures in a Tb single crystal was used to detect the resonance signal. From the resonance frequencies, (mu sub 1)=480.0(4) MHz and (mu sub 2)=842.3(3) MHz, the authors derive the magnetic dipole and electric quadrupole interaction frequencies independently. They are (mu sub M)=1385.8(1.6) MHz and (mu sub P)=181.2(4) MHz; (mu sub M) is about 5% higher than expected from the NMR of Tb: (159)Tb combined with an ESR determination of the g-factor ratio, but is in agreement with bulk nuclear orientation results.

801.358
PB89-127054 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

Muon-Induced Radioactivity in Underground Detectors.

Final rept.,
J. S. O'Connell, and F. J. Schima. 1988, 3p
Pub. in Physical Review D 38, n7 p2277-2279, 1 Oct 88.

Keywords: *Induced radioactivity, Half life, Sea level, Reprints, *Neutrino detection, Cosmic muons, Radiation detectors, Beryllium T, Underground, MeV range 01-10.

Induced radioactivities that generate background events in particle detectors used for low-energy (less than 5 MeV) neutrino detection are discussed. Production rates from cosmic-ray muons incident on detector materials at sea level and underground are estimated. The production of (7)Be at sea level in detector materials is shown to be a serious problem.

801.359
PB89-127062 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

Interactions of Atmospheric Neutrinos in Nuclei at Low Energy.

Final rept.,
T. K. Gaisser, and J. S. O'Connell. 1986, 4p
Pub. in Physical Review D 34, n3 p822-825, 1 Aug 86.

Keywords: Leptons, Electrons, Muons, Weak interactions, Oxygen, Reprints, *Cosmic neutrinos, Particle decay, Radiation detectors, Underground.

The authors have calculated lepton spectra induced by cosmic ray neutrinos interacting in oxygen, taking account of nuclear effects. The results are accurate to energies as low as 50 MeV for electrons and to threshold for muons, and they are consistent with measurements made with the large, water-filled nucleon decay detectors.

801.360
PB89-127294 PC A12/MF A01

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Radiation Research.

Center for Radiation Research (of the National Institute of Standards and Technology) Technical Activities for 1988.

C. E. Kuyatt. Nov 88, 262p NISTIR-88/3869
See also PB84-217470.

Keywords: *Research projects, *Radiation, Plasma radiation, Nuclear radiation, Radiometry, Radiation measuring instruments, Sources, Spectroradiometers, Ionizing radiation, Nuclear physics, Atomic spectroscopy, National Bureau of Standards, Center for Radiation Research, Radiation physics.

The report summarizes research projects, measurement method development, calibration and testing, and data evaluation activities that were carried out during Fiscal Year 1988 in the NIST Center for Radiation Research. These activities fall in the areas of atomic and plasma radiation, radiation physics, radiometric physics, radiation sources and instrumentation, ionizing radiation, and nuclear physics.

801.361
PB89-132302 PC A22/MF A01

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Atomic, Molecular and Optical Physics.

Center for Atomic, Molecular, and Optical Physics Technical Activities, 1988.

K. Gebbie. Dec 88, 516p NISTIR-88/3881

Keywords: *Records, *Physics, *Physical chemistry, Surface chemistry, Molecular spectroscopy, Atomic physics, Atomic spectra, Plasmas(Physics), Optics, Quantum chemistry, Quantum theory, Metrology, Standards, Fundamental constants, Radiation, Lasers, Center for Atomic Molecular and Optical Physics.

The report summarizes the research and technical activities of the Center for Atomic, Molecular and Optical Physics during the Fiscal Year 1988. These activities include work in the areas of fundamental constants, radiation physics, surface science, plasma spectroscopy, time and frequency, quantum metrology, and quantum physics.

801.362
PB89-132757 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

National Bureau of Standards Data Base of Photon Absorption Cross Sections from 10 eV to 100 GeV.

Final rept.,
E. B. Saloman, J. H. Hubbell, and M. J. Berger. 1988, 7p

Sponsored by Department of Energy, Washington, DC. Pub. in X-ray and Vacuum Ultraviolet Interaction Data Bases, Calculations, and Measurements, v911 p100-106 1988.

Keywords: *Photon cross sections, Absorption cross sections, Experimental data, Theories, Comparison, X-rays, Reprints, *Data bases, *Photoabsorption, *Photoionization, National Institute of Standards and Technology.

The National Bureau of Standards (NBS) has maintained a data base of experimental and theoretical photon absorption cross sections (attenuation coefficients) since 1950. Currently the measured data include more than 20,000 data points abstracted from more than 500 independent literature sources including both published and unpublished reports and private communications. The authors have recently completed a systematic comparison over the energy range 0.1-100 keV of the measured cross sections in the NBS data base with cross sections obtained using the photoionization cross sections calculated by Scofield and the semi-empirical set of recommended photoionization cross section values of Henke et al. Cross sections for coherent and incoherent scattering were added to that of photoionization to obtain a value which could be compared to the experimental results. The authors have recently developed a PC-based computer program to generate theoretical cross section values based on Scofield's calculation. They have also completed a related program to enable a user to extract selected data from the measured data base.

801.363
PB89-133375 (Order as PB89-133367, PC A04)

National Inst. of Standards and Technology, Gaithersburg, MD.

Kinetic Studies Using a Highly Sensitive Microphone Detector.

W. Braun, P. Dagaut, and B. C. Cadoff. 9 Jun 88, 12p

Included in Jnl. of Research of the National Institute of Standards and Technology, v93 n6 p643-654 Jun 88.

Keywords: *Microphones, *Acoustic detection, *Kinetics, *Energy transfer, Heat flux, Measurement, Carbon dioxide lasers, Wave form analysis.

A very sensitive microphone detector is used to study fast kinetic rate processes in the gas phase resulting in the generation of heat. The rate of heat evolution in turn produces a short duration pressure pulse which drives the microphone. The frequency response of the microphone is somewhat slower than required to record these pulses as they actually appear at the detector. The theory of the method used for the data reduction is presented. It is based upon the Green's Function method which expresses the time dependent microphone signal, X, (t), as the convolution of the pressure pulse function, f(t), by the microphone's impulse response function, G(t). A Fourier analysis of X(t) and the two relevant functions, f(t) and G(t), at a single

frequency, allows direct determination of the rate constant for the kinetic process under study. The method is demonstrated by applying it to the study of vibrational energy relaxation of pentafluorobenzene in argon buffer gas and gives results in agreement with other experimental methods.

SPACE TECHNOLOGY

Space Safety

801,364

PB88-178553 PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Spacecraft Fire Detection and Extinguishment: A Bibliography.

Final rept.,
N. H. Jason. Feb 88, 65p NBSIR-88/3712, NASA/CR-180880
Contract NASA-C-32000-J
Sponsored by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.

Keywords: *Fire detection systems, *Spacecraft, Bibliographies, Microgravity.

Pertinent fire detection and extinguishment references have been identified to further the knowledge of spacecraft fire safety. To broaden the scope of the bibliography, other unusual environments, e.g., aircraft, submarine, ship, have been included. In addition, for a more comprehensive view of the spacecraft fire safety problem, selected subjects are included, e.g., materials flammability, smoke, human behavior. The references will provide the researcher with access to state-of-the-art works and historic works. Selected references from the 1960s have been included, but the emphasis is on references published from 1975 to 1987.

Spacecraft Trajectories & Flight Mechanics

801,365

PB88-195060 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.

Note on Cid's Radial Intermediary and the Method of Averaging.

Final rept.,
A. Deprit, and S. Ferrer. 1987, 9p
Pub. in Celestial Mechanics 40, p335-343 1987.

Keywords: Artificial satellites, Celestial mechanics, Hamiltonian functions, Reprints, Satellite orbits, Orbit calculation.

In the main problem of artificial satellite theory, the difference between the Hamiltonian and Cid's radial intermediary, is a function of the argument of latitude whose average over the mean anomaly is zero.

TRANSPORTATION

Air Transportation

801,366

PB88-229521 PC A05/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Fire Environment in Counterflow Ventilation: The In-Flight Cabin Aircraft Fire Problem,
B. J. McCaffrey. Jun 88, 100p NBSIR-88/3806
Prepared in cooperation with Maryland Univ. at Baltimore. Sponsored by Federal Aviation Administration Technical Center, Atlantic City, NJ.

Keywords: *Aviation safety, *Aircraft fires, *Aircraft cabins, Fire fighting, Flame propagation, Ventilation, Air circulation, Tables(data), Graph(data).

Using propane gas burning in a diffusive mode, fire sources up to the equivalent heat release rate of a fully involved seat were simulated in an approx. 1/2-scale closed section of a ventilated-wide-body aircraft cabin. The ventilation flow direction was as in a commercial practice-counter to that of the buoyancy driven fire gases, i.e., fresh air was forced in at the top of the enclosure and drawn out at the bottom. Results indicate that for nominal ventilation rates the potential for significant enthalpy exchange through ventilation in times corresponding to a few airchanges is limited. That is, only a small proportion of the energy release rate of the fire is getting exhausted. Correlations of thermal conditions in the enclosure as a function of time, heat release rate of the fire, and position in the cabin are presented. Semi-infinite transient conduction models appear adequate in capturing the essential features of the fire-celling thermal interaction. Reduced data on PC-readable floppy disks for the entire test series will be made available for future cabin modeling purposes.

Pipeline Transportation

801,367

PB89-132849 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.

Gas Flow Measurement: Practical Aspects and Research Results.

Final rept.,
G. E. Mattingly, and N. E. Mease. 1988, 26p
Pub. in Proceedings of IGT (Institute of Gas Technology) Symposium on Natural Gas Energy Measurement, Chicago, IL., June 27-28, 1988, p1-26.

Keywords: *Gas flow, *Flow rate, *Measurements, Metrology, Calibrating, Performance evaluation, Fluid flow, Flowmeters, Reprints, Fluid meters.

Increased concerns for improved gas flowrate measurements exist today in our nation's marketplaces, in our continuous process industries, and in the technologies which impact public safety and our national defense. To respond to these concerns, improvements are being sought in fluid measurements in existing installations and in fluid meters which are being retrofitted into flow systems where none previously existed. For all of these reasons, the NBS-Gaithersburg calibration facilities for gas flow should be known, accessible, and adequate to expressed needs. The NBS-Gaithersburg calibration techniques, facilities, ranges and levels of performance are briefly described for gas flowrate.

Railroad Transportation

801,368

PB88-194519 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Ultrasonic Characterization of Residual Stress and Flaws in Cast Steel Railroad Wheels.

Final rept.,
A. V. Clark, R. E. Schramm, H. Fukuoka, and D. V. Mitrakovic. 1988, 4p
Sponsored by Federal Railroad Administration, Washington, DC.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Ultrasonics Symposium, Denver, CO., October 14-16, 1987, v2 p1079-1082 1988.

Keywords: *Vehicle wheels, *Wheels, *Residual stress, *Ultrasonic tests, Steel castings, Crack propagation, Nondestructive tests, Rayleigh waves, Birefringence, *Railroad wheels.

Two ongoing safety problems in cast steel railroad wheels are the buildup of residual stress in the rim and the growth of cracks in the tread. Electromagnetic-acoustic transducer (EMAT) technology shows promise for the nondestructive evaluation of both. The acoustoelastic effect generates a small but measurable acoustic birefringence in the presence of stress fields, while Rayleigh waves are sensitive to surface disruptions from flaws. Experimental investigations of both problems indicate that these noncontact inspection methods lend themselves to automated use in a railway.

801,369

PB88-238613 PC A05/MF A01
National Bureau of Standards (IMSE), Gaithersburg, MD.

Dynamic Mechanical Properties of Two AAR M128 and One ASTM A212-B Steel Tank Car Head Plates.

Rept. no. 14,
J. G. Early, C. G. Interrante, S. R. Low, and B. A. Fields. Jun 88, 99p NBSIR-88/3690
See also PB81-205098 and PB81-179483. Sponsored by Federal Railroad Administration, Washington, DC.

Keywords: *Tank cars, *Metal plates, *Railroad cars, Metallurgical analysis, Impact tests, High strength steels, Crack propagation, Crack initiation.

Instrumented precracked Charpy impact testing and dynamic tear testing were carried out on steel plate samples taken from three railroad tank cars. Two of the samples were given as AAR M128, a high strength carbon manganese steel, while the third was reported to be ASTM A212-65, a high strength carbon silicon steel. Values were found for the ranges of transition temperatures and for the energies absorbed, including crack initiation energy, crack propagation energy, and total energy.

801,370

PB88-238670 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Flaw Detection in Railroad Wheels Using Rayleigh-Wave EMATs (Electromagnetic Acoustic Transducers).

Final rept.,
R. E. Schramm, A. V. Clark, D. V. Mitrakovic, and P. J. Shull. 1988, 8p
Sponsored by Federal Railroad Administration, Washington, DC.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v7B p1661-1668 1988.

Keywords: *Railroads, *Vehicle wheels, *Wheels, *Nondestructive tests, Rayleigh waves, Automation, Reprints, Flaw detection.

Railroad wheels experience high stresses from sources such as dynamic and static loads and residual strains generated by heat input during braking. Possible flaws include cracks originating at or near the tread surface or in the flange, as well as 'shelling' (peeling of the tread surface). The authors examined the use of Rayleigh-wave EMATs in a pitch-catch mode for possible non-contact wheel inspection. The EMATs were meanderlines which use a large Nd-Fe-B permanent magnet. A newly designed MOSFET amplifier delivered up to 140 A at 500 kHz to the transmitting EMAT. The system can deliver a pulse sufficiently strong to travel around the wheel circumference at least 14 times. The authors present signal data from artificial cracks of two depths and discuss problems associated with extending the technique to roll-by inspection.

801,371

PB89-123350 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Characterization of Residual Stress and Texture in Cast Steel Railroad Wheels.

Final rept.,
A. V. Clark, H. Fukuoka, D. V. Mitrakovic, and J. C. Moulder. 1986, 8p
Sponsored by Federal Railroad Administration, Washington, DC.
Pub. in Ultrasonics 24, n5 p281-288 1986.

Keywords: *Steels, *Vehicle wheels, *Ultrasonic tests, *Railroad cars, Castings, Sound transducers, Residual stress, Texture, Thickness, Piezoelectricity, Birefringence, Electromagnetic wave transmission, Sawing, Reprints.

TRANSPORTATION

Railroad Transportation

Residual stress and texture were characterized in the rim of a cast steel railroad wheel, using both an electromagnetic-acoustic transducer (EMAT) and a piezoelectric transducer. Orthogonally polarized shear-horizontal waves were propagated through the thickness of the rim, and arrival times measured (in pulse-echo) with a precision of about 0.00001. The difference in arrival times (birefringence) is related to the difference of principal stresses and also to texture. The wheel had been sawcut in a previous experiment; the residual stress had been relieved at the sawcut. The birefringence was measured at the sawcut and subtracted from the birefringence measured at stressed regions. This allowed the authors to map out variations in stress around the circumference of the wheel. Stresses measured with the EMAT and piezoelectric transducer agreed to within 10 MPa.

URBAN & REGIONAL TECHNOLOGY & DEVELOPMENT

Fire Services, Law Enforcement, & Criminal Justice

801,372

PB88-194311 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg,
MD. Systems Components Div.
**Topological Coding of Single Fingerprints for
Automated Comparison.**

Final rept.,
M. K. Sparrow, and P. J. Sparrow. 1985, 9p
Sponsored by Commonwealth Fund, New York.
Pub. in Proceedings of Carnahan Conference on Security
Technology, Lexington, KY., May 15-17, 1985,
p149-157.

Keywords: *Topology, Coding, Comparison, Automation, Algorithms, Identification systems, *Automated fingerprint processing, *Fingerprints.

The motivation for seeking topological descriptions of single fingerprints is provided by the elasticity of the human skin; successive rolled impressions from the same finger will invariably have suffered a degree of relative distortion (translation, rotation and stretching). Topology based systems should be free from the detrimental effects of plastic distortion. Systems are described for the extraction of simple topological codes from rolled impressions of the pattern types 'loops', 'whorls' and 'arches'. The generated codes take the form of vectors or simple digital arrays. The nature and frequency of changes that may occur in such codes is investigated-and fingerprint comparison algorithms, based on these topological codes, are developed.

Regional Administration & Planning

801,373

PB89-107718 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD. Center for Computing and Applied Mathematics.

Internal Revenue Service Post-of-Duty Location Modeling System: Users Manual Version 4.0,
P. Domich, R. Jackson, and M. McClain. Sep 88, 47p
NISTIR-86/3471/1
See also PB87-168811. Sponsored by Internal Revenue Service, Washington, DC.

Keywords: *Regional planning, *Site surveys, Cost effectiveness, Microcomputers, Manuals, Models, Computer systems programs, Computer systems hardware, Maps, *Internal revenue service, *Interactive graphics, *Site selection, Computer software, Government agencies.

The report is a user's guide for a microcomputer package which was designed by the National Institute of Standards and Technology (formerly National Bureau of Standards), to assist the Internal Revenue Service in choosing locations for its posts-of-duty which will minimize costs to the IRS and to the taxpayer. The

user may select the types of costs to be considered and may specify potential locations for new posts-of-duty. The system displays maps showing workload for a district, current post-of-duty locations and new post-of-duty locations. The manual provides hardware and software requirements for the system, installation procedures, data file formats, and detailed operating instructions.

Transportation & Traffic Planning

801,374

PB88-190392 PC A06/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.

Paratransit Advanced Routing and Scheduling System Documentation: Generalized Reporting Subsystem,
W. G. Hall, H. K. Hung, and R. E. Chapman. Jul 87, 108p NBSIR-85/3179
See also PB86-153517. Sponsored by Urban Mass Transportation Administration, Washington, DC.

Keywords: *Urban transportation, Routing, Scheduling, Computer software, Dispatching systems, FORTRAN, *Dial a ride systems, *Paratransit.

The Advanced Routing and Scheduling System (ARSS) is a software system designed to route and schedule patrons in a dial-a-ride environment. The system consists of three subsystems: CONENV, a preprocessor, constructs physical and policy environments; RSDAR routes and schedules patrons; and GREPOR generates hard copy of all necessary reports. The report only describes GREPOR. GREPOR is a software system which creates all reports necessary for the routing, scheduling, and dispatching of a paratransit fleet. The system is very general; options include several report types, each of which has several print line types. Print items are selected according to information supplied to the user. The model is written in FORTRAN and complies with the American National Standards Institute X3.9-1978 standard for that language.

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PB89-127542 Survey Sample Design for Microfilm Inspection at the National Archives. PB89-127542	800,827	PC A03/MF A01
PB89-127559 Study of the Ignition Inhibiting Properties of Compressed Air Foam. PB89-127559	800,141	PC A03/MF A01
PB89-127567 XRAYL: A Powder Diffraction Profile Refinement Program. PB89-127567	800,195	PC A03/MF A01
PB89-127575 CAD Directed Automated Part Handling User's Reference Manual. PB89-127575	800,841	PC A03/MF A01
PB89-127732 Effect of Water on Piloted Ignition of Cellulosic Materials. PB89-127732	800,557	PC A03/MF A01
PB89-128870 NBS (National Bureau of Standards) Real-Time Control System User's Reference Manual (Version 2.2C). PB89-128870	800,595	PC A17/MF A01
PB89-128888 NIST (National Institute of Standards and Technology) Measurement Services: Liquid-In-Glass Thermometer Calibration Service. PB89-128888	800,798	PC A07/MF A01
PB89-128946 New Models to Assess Behavioral and Physiological Performance of Animals during Inhalation Exposures. PB89-128946	801,109	PC A08/MF A01

- PB89-129134**
Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices as Adopted by the 73rd National Conference on Weights and Measures, 1988 (1989 Edition),
PB89-129134 800,881 PC A11/MF A01
- PB89-129142**
Statistical Concepts in Metrology-With a Postscript on Statistical Graphics.
PB89-129142 800,919 PC A04/MF A01
- PB89-129480**
Constructing Delaunay Triangulations for Sets Constrained by Line Segments.
PB89-129480 801,045 PC A03/MF A01
- PB89-129498**
Optical Radiation Measurements: High Pressure Sodium Discharge Lamp Characterization for Use as Standards of Geometrically Total Luminous Flux.
PB89-129498 800,861 PC A04/MF A01
- PB89-129506**
System Description and Design Architecture for Multiple Autonomous Undersea Vehicles,
PB89-129506 801,112 PC A07/MF A01
- PB89-129514**
Computer Science and Technology: Smart Card Technology: New Methods for Computer Access Control.
PB89-129514 800,622 PC A04/MF A01
- PB89-129522**
Techniques for Treating Uncertainty and Risk in the Economic Evaluation of Building Investments.
PB89-129522 800,003 PC A05/MF A01
- PB89-129530**
Formation of Lubricating Films at Elevated Temperatures from the Gas Phase.
PB89-129530 800,913 PC A06/MF A01
- PB89-129548**
Laser Induced Damage in Optical Materials: 1986.
PB89-129548 801,182 PC A99/MF E04
- PB89-129555**
Technical Digest-Symposium on Optical Fiber Measurements, 1988,
PB89-129555 801,183 PC A10/MF A01
- PB89-129563**
Uniform Laws and Regulations as Adopted by the National Conference on Weights and Measures (73rd), 1988.
PB89-129563 800,882 PC A09/MF A01
- PB89-131254**
Journal of Research of the National Bureau of Standards, Volume 93, Number 5, September-October 1988.
PB89-131254 800,883 PC A04
- PB89-131262**
Diffraction Imaging (Topography) with Monochromatic Synchrotron Radiation,
PB89-131262 801,264
(Order as PB89-131254, PC A04)
- PB89-131270**
Convective Velocity Effects on a Thermistor in Water,
PB89-131270 800,884
(Order as PB89-131254, PC A04)
- PB89-131288**
Octacalcium Phosphate Solubility Product from 4 to 37 C,
PB89-131288 800,196
(Order as PB89-131254, PC A04)
- PB89-131916**
Report of Roof Inspection: Partial Delamination of Adhesive-Bonded Seams at an Army Facility,
PB89-131916 800,102 PC A03/MF A01
- PB89-131924**
Friability of Spray-Applied Fireproofing and Thermal Insulations: Laboratory Evaluation of Prototype Test Devices,
PB89-131924 800,127 PC A05/MF A01
- PB89-132104**
Generation of Standard Electromagnetic Fields in a TEM (Transverse Electromagnetic) Cell.
PB89-132104 800,799 PC A10/MF A01
- PB89-132302**
Center for Atomic, Molecular, and Optical Physics Technical Activities, 1988,
PB89-132302 801,361 PC A22/MF A01
- PB89-132310**
Research for Electric Energy Systems: An Annual Report (1987),
PB89-132310 800,722 PC A05/MF A01
- PB89-132328**
Hazard I-Results of a User Evaluation on the Prototype Software,
PB89-132328 800,862 PC A03/MF A01
- PB89-132336**
Investigation of a User-Operated Mass Calibration Package,
PB89-132336 800,800 PC A04/MF A01
- PB89-132344**
Suggested Research Topics for the Construction Engineering Research Laboratory (CERL) Program, Evaluation of Roofing Materials Degradation Processes,
PB89-132344 800,128 PC A03/MF A01
- PB89-132351**
Ongoing Implementation Agreements for Open Systems Interconnection Protocols. Volume 2.1. Continuing Agreements,
PB89-132351 800,613 PC A09/MF A01
- PB89-132575**
Checking the Net Contents of Packaged Goods.
PB89-132575 800,142 PC A13/MF A01
- PB89-132732**
Low-Accelerating-Voltage SEM (Scanning Electron Microscope) Magnification Standard Prototype.
PB89-132732 800,885 Not available NTIS
- PB89-132740**
Elastic Constants of Polycrystalline Y1Ba2Cu3O7-x.
PB89-132740 801,265 Not available NTIS
- PB89-132757**
National Bureau of Standards Data Base of Photon Absorption Cross Sections from 10 eV to 100 GeV.
PB89-132757 801,362 Not available NTIS
- PB89-132765**
Multi-Zone Contaminant Dispersal Analysis Using an Element Assembly Approach.
PB89-132765 800,764 Not available NTIS
- PB89-132773**
Optically Linked Electric and Magnetic Field Sensor for Poynting Vector Measurements in the Near Field of Radiating Sources.
PB89-132773 800,568 Not available NTIS
- PB89-132781**
Recent Tunneling Measurements of 90 K Superconductors at NBS (National Bureau of Standards).
PB89-132781 801,266 Not available NTIS
- PB89-132799**
Single Crystal HoBa2Cu3Ox Break Junctions.
PB89-132799 801,267 Not available NTIS
- PB89-132807**
X-ray Scattering Studies: The Structure and Melting of Pb on Cu(110) Surfaces.
PB89-132807 801,268 Not available NTIS
- PB89-132815**
Statistical Evaluation of Wavelength-Dispersive Digital Compositional Mapping with the Electron Microprobe.
PB89-132815 800,197 Not available NTIS
- PB89-132823**
Application of Wavelength-Dispersive Digital Compositional Mapping to High-Temperature Superconductors.
PB89-132823 800,948 Not available NTIS
- PB89-132831**
Gas Flowrate Metrology.
PB89-132831 800,243 Not available NTIS
- PB89-132849**
Gas Flow Measurement: Practical Aspects and Research Results.
PB89-132849 801,367 Not available NTIS
- PB89-132856**
Flowmeter Installation Effects.
PB89-132856 800,817 Not available NTIS
- PB89-132864**
Estimating the Environment and the Response of Sprinkler Links in Compartment Fires with Draft Curtains and Fusible Link-Actuated Ceiling Vents: An Overview.
PB89-132864 800,129 Not available NTIS
- PB89-132872**
State of Fire Research and Safety.
PB89-132872 800,558 Not available NTIS
- PB89-132880**
Collisional Electron Detachment Cross Section Measurements for SF6(1-), SF5(1-) and F(1-) in SF6: Implications for Interpretations of Existing Ion Transport and Breakdown Probability Data.
PB89-132880 800,723 Not available NTIS
- PB89-132898**
Stochastic Properties of Negative Corona (Trichel) Pulses in SF6/O2 Mixtures.
PB89-132898 800,724 Not available NTIS
- PB89-132906**
Electrical Fast Transient Tests: Applications and Limitations.
PB89-132906 800,729 Not available NTIS
- PB89-132914**
Active Late-Type Stars.
PB89-132914 800,049 Not available NTIS
- PB89-132922**
Application of Semiconductor Diode Lasers to Probe Photo-dissociation Dynamics.
PB89-132922 800,255 Not available NTIS
- PB89-132930**
Introduction and Summary for Mechanical Relaxation of Residual Stresses.
PB89-132930 800,809 Not available NTIS
- PB89-132948**
Multiwavelength Observations of Magnetic Fields and Related Activity on XI Bootis A.
PB89-132948 800,050 Not available NTIS
- PB89-132955**
Ultrasonic Measurements of the Elastic Properties of Dental Materials.
PB89-132955 800,065 Not available NTIS
- PB89-132963**
Transient and Residual Stress in Dental Porcelain Fused-to-Metal Restorations as Affected by the Thermal Expansion Coefficients of the Alloys.
PB89-132963 800,066 Not available NTIS
- PB89-132971**
Applications of Microindentation Methods in Tribology Research.
PB89-132971 801,000 Not available NTIS
- PB89-132989**
Role of Polymer Toughness in Matrix Dominated Composite Fracture.
PB89-132989 800,969 Not available NTIS
- PB89-132997**
Implications of Molecular Speciation and Topology of Environmental Metals: Uptake Mechanisms and Toxicity of Organotins.
PB89-132997 800,768 Not available NTIS
- PB89-133003**
Dental Composites: Strength Properties via Weibull Statistics.
PB89-133003 800,067 Not available NTIS
- PB89-133011**
Modelling of the Potential at the Tip of a Transgranular Stress-Corrosion Crack in the Alpha-Brass-Ammonia System.
PB89-133011 801,024 Not available NTIS
- PB89-133367**
Journal of Research of the National Institute of Standards and Technology. Volume 93, Number 6, November-December 1988.
PB89-133367 801,067 PC A04
- PB89-133375**
Kinetic Studies Using a Highly Sensitive Microphone Detector.
PB89-133375 801,363
(Order as PB89-133367, PC A04)
- PB89-133383**
Solvent-Free Injection in Supercritical Fluid Chromatography Using Sintered Glass Deposition,
PB89-133383 800,198
(Order as PB89-133367, PC A04)
- PB89-133391**
Enzyme-Enhanced Electrochemical Immunoassay for Phenytoin,
PB89-133391 801,068
(Order as PB89-133367, PC A04)
- PB89-133409**
Liposome-Based Flow Injection Immunoassay System,
PB89-133409 801,069
(Order as PB89-133367, PC A04)
- PB89-133425**
Remeasurement of a Silicon Lattice Period.
PB89-133425 800,476 Not available NTIS
- PB89-133516**
National Conference on Weights and Measures (73rd), 1988,
PB89-133516 800,818 PC A17/MF A01
- PB89-133524**
Facilities of the National Institute of Standards and Technology, 1988.
PB89-133524 800,801 PC A03/MF A01
- PB89-133532**
Manipulator Primitive Level Task Decomposition.
PB89-133532 800,903 PC A04/MF A01
- PB89-133540**
Manipulator Servo Level Task Decomposition.
PB89-133540 800,904 PC A03/MF A01
- PB89-133557**
Computer Science and Technology: Data Administration: Management and Practice. Proceedings of the First DAMA (Data Administration Management Association) Symposium.
PB89-133557 800,824 PC A06/MF A01
- PB89-133565**
NIST (National Institute of Standards and Technology) Research Reports, October 1988.
PB89-133565 800,819 PC A03/MF A01
- PB89-133573**
Standard Reference Materials: Preparation and Certification of SRM-2530, Ellipsometric Parameters Delta and Psi and Derived Thickness and Refractive Index of a Silicon Dioxide Layer on Silicon.
PB89-133573 800,949 PC A03/MF A01
- PB89-134209**
Electrochemical Technique for Rapidly Evaluating Protective Coatings on Metals.
PB89-134209 800,886 PC A03/MF A01
- PB89-135263**
Heat Pipe Oven Molecular Beam Source.
PATENT-4 789 779 800,737 Not available NTIS
- PB89-135685**
Journal of Physical and Chemical Reference Data, Volume 17, Number 3, 1988.
PB89-135685 800,477 Not available NTIS
- PB89-135693**
Evaluated Chemical Kinetic Data for the Reactions of Atomic Oxygen O(3P) with Saturated Organic Compounds in the Gas Phase.
PB89-135693 800,478 Not available NTIS

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PB89-135701 Rate Constants for Reactions of Inorganic Radicals in Aqueous Solution. PB89-135701 800,479 Not available NTIS	PB89-136535 Back-to-Back Accelerometer as a High Frequency Vibration Standard. PB89-136535 800,887 Not available NTIS	PB89-137657 801,040 Not available NTIS
PB89-135719 Recommended Data on the Electron Impact Ionization of Atoms and Ions: Fluorine to Nickel. PB89-135719 800,480 Not available NTIS	PB89-136543 Computational Ontology. PB89-136543 801,052 Not available NTIS	PB89-137665 Coping with Non-Existent National Standards: An NBS (National Bureau of Standards) Perspective. PB89-137665 800,889 Not available NTIS
PB89-135727 Journal of Physical and Chemical Reference Data, Volume 17, 1988, Supplement No. 1. Gas-Phase Ion and Neutral Thermochemistry. PB89-135727 800,481 Not available NTIS	PB89-136550 Trends in Polymer Development and Analytical Techniques. PB89-136550 800,507 Not available NTIS	PB89-137673 Evaluation of Relative Humidity Values for Saturated Aqueous Salt Solutions Using Osmotic Coefficients between 50 and 100 C. PB89-137673 800,490 Not available NTIS
PB89-135735 Journal of Physical and Chemical Reference Data, Volume 17, 1988, Supplement No. 4. Atomic Transition Probabilities Iron through Nickel. PB89-135735 800,482 Not available NTIS	PB89-136568 Nature of the Glass Transition. PB89-136568 800,487 Not available NTIS	PB89-137681 Rating of Mixed Split Residential Air Conditioners. PB89-137681 800,089 Not available NTIS
PB89-138295 Interaction of Lighting, Heating and Cooling Systems in Buildings. Interim Report. PB89-138295 800,088 PC A08/MF A01	PB89-137533 Methacrylate Oligomers with Pendant Isocyanate Groups as Tissue Adhesives. PB89-137533 800,920 Not available NTIS	PB89-137699 NBS (National Bureau of Standards) Calibration Procedures for Horizontal Dipole Antennas (25 to 1000 MHz). PB89-137699 800,630 Not available NTIS
PB89-136303 Vertical Machining Workstation Systems. PB89-136303 800,858 PC A04/MF A01	PB89-137541 Basis for Quality Assurance of Chemical Measurements and Standards. PB89-137541 800,199 Not available NTIS	PB89-141089 Smoke Point Height and Fire Properties of Materials. PB89-141089 800,559 PC A04/MF A01
PB89-136311 Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, April to June 1988, with 1988 CEEE Events Calendar. PB89-136311 800,725 PC A03/MF A01	PB89-137558 Bright-Field Image Correction Using Various Image-Processing Tools. PB89-137558 801,184 Not available NTIS	PB89-141097 Tracer Gas Techniques for Studying Building Air Exchange. PB89-141097 800,090 PC A03/MF A01
PB89-136329 Proceedings of the Federal Information Processing Standards (FIPS) Workshop on Information Resource Dictionary System (IRDS) Applications. PB89-136329 800,825 PC A09/MF A01	PB89-137566 Central Nervous System as a Low and High Level Control System. PB89-137566 801,094 Not available NTIS	PB89-141105 Accumulation and Fate of Tributyltin Species in Microbial Biofilms. PB89-141105 801,001 PC A03/MF A01
PB89-136337 Journal of Physical and Chemical Reference Data, Volume 17, Number 2, 1988. PB89-136337 800,517 Not available NTIS	PB89-137574 Hierarchical Control of Intelligent Machines Applied to Space Station Telerobots. PB89-137574 800,905 Not available NTIS	PB89-141113 Burning Characteristics of Combat Ship Compartments and Vertical Fire Spread. PB89-141113 800,560 PC A03/MF A01
PB89-136345 Electronic Energy Levels of Small Polyatomic Transient Molecules. PB89-136345 800,483 Not available NTIS	PB89-137582 Statistics of Pit Initiation: Analysis of Current Transients during Passive Film Breakdown. PB89-137582 800,726 Not available NTIS	PB89-141121 Directory of Organizations and Standards That Affect the Movement of Telecommunications Information for Ten Pacific Rim Countries. PB89-141121 800,573 PC A04/MF A01
PB89-136352 Critical Review of Rate Constants for Reactions of Hydrated Electrons, Hydrogen Atoms and Hydroxyl Radicals (OH/ O(1-)) in Aqueous Solution. PB89-136352 800,484 Not available NTIS	PB89-137590 Euclidian Distance Mapping for Shape Characterization of Alloy Grain Boundaries. PB89-137590 800,488 Not available NTIS	PB89-141154 Energy Related Inventions Program: A Joint Program of the Department of Energy and the National Institute of Standards and Technology. Status Report October 1988. PB89-141154 800,754 PC A14/MF A01
PB89-136360 Chemical Kinetic Data Base for Combustion Chemistry. Part 3. Propane. PB89-136360 800,485 Not available NTIS	PB89-137608 Languages and Software Parts for Elliptic Boundary-Value Problems. PB89-137608 801,046 Not available NTIS	PB89-148332 Design and Construction of a State-of-the-Art High Temperature Tribometer. PB89-148332 800,950 PC A10/MF A01
PB89-136501 Progress in Force Measurement at NBS (National Bureau of Standards). PB89-136501 800,820 Not available NTIS	PB89-137616 Checklist for Radioanalytical Quality Assurance. PB89-137616 800,200 Not available NTIS	PB89-148340 High-Temperature Superconductivity: Abstracts of NIST (National Institute of Standards and Technology) Publications, 1987-1988. PB89-148340 800,951 PC A03/MF A01
PB89-136519 Thermodynamic Values in the Vicinity of the Specific Volume Anomaly for Water. PB89-136519 800,486 Not available NTIS	PB89-137624 NBS (National Bureau of Standards) Work on Neutron Resonance Radiography. PB89-137624 800,201 Not available NTIS	PB89-148357 Ceramic Tribology: Methodology and Mechanisms of Alumina Wear. PB89-148357 800,952 PC A11/MF A01
PB89-136527 AMPLE: A Programming Language Environment for Automated Manufacturing. PB89-136527 800,859 Not available NTIS	PB89-137632 Retrograde Condensation of Carbon Dioxide: N-Decane Mixtures on Horizontal Cylinders. PB89-137632 800,489 Not available NTIS	PB89-148985 Vapor Phase Deposition Studies of Phosphate Esters on Metal and Ceramic Surfaces. PB89-148985 800,995 PC A08/MF A01
	PB89-137640 NBS (National Bureau of Standards) Research on the Effects of Pipe Roughness and Flow Conditioners on the Orifice Discharge Coefficient. PB89-137640 800,888 Not available NTIS	UDR-TR-87-135 Improved Furniture Fire Model within 'FAST' HEMFAST-2. PB88-192414 800,095 PC A05/MF A01
	PB89-137657 Ignition Characteristics of Several Alloys for Use in Oxygen Systems.	

APPENDIX A

List of Depository Libraries in the United States

ALABAMA

Alexander City

Alexander City State Junior College Thomas S. Russell Library (1967)*

Auburn

Auburn University Ralph Brown Draughon Library (1907)

Birmingham

Birmingham Public Library (1895)
Birmingham-Southern College Library (1932)
Jefferson State Junior College James B. Allen Library (1970)
Miles College C. A. Kirkendoll Learning Resource Center (1980)
Samford University Library (1884)

Enterprise

Enterprise State Junior College Learning Resources Center (1967)

Fayette

Brewer State Junior College Learning Resources Center Library (1979)

Florence

University of North Alabama Collier Library (1932)

Gadsden

Gadsden Public Library (1963)

Huntsville

University of Alabama in Huntsville Library (1964)

Jacksonville

Jacksonville State University Houston Cole Library (1929)

Mobile

Mobile Public Library (1963)
Spring Hill College Thomas Byrne Memorial Library (1937)
University of South Alabama Library (1968)

Montgomery

Alabama Public Library Service (1984)

Alabama Supreme Court and State Law Library (1884)
Auburn University at Montgomery Library (1971) REGIONAL
Air University Library Maxwell Air Force Base (1963)

Normal

Alabama Agricultural and Mechanical University J. F. Drake Memorial Learning Resources Center (1963)

Troy

Troy State University Library (1963)

Tuscaloosa

University of Alabama Library (1860) REGIONAL
University of Alabama School of Law Library (1967)

Tuskegee

Tuskegee University Hollis Burke Frissell Library (1907)

ALASKA

Anchorage

Anchorage Law Library (1973)
Anchorage Municipal Libraries Z. J. Loussac Public Library (1978)
University of Alaska at Anchorage Library (1961)
U.S. Department of Interior Alaska Resources Library (1981)
U.S. District Court Library (1983)

Fairbanks

University of Alaska Elmer E. Rasmuson Library (1922)

Juneau

Alaska State Library (1900)
University of Alaska-Juneau Library (1981)

Ketchikan

Ketchikan Community College Library (1970)

AMERICAN SAMOA

Pago Pago

Community College of American Samoa Library (1985)

*Year designated.

ARIZONA

Coolidge

Central Arizona College (1973)

Flagstaff

Northern Arizona University Library (1937)

Glendale

Glendale Public Library (1986)

Holbrook

Northland Pioneer College (1985)

Mesa

Mesa Public Library (1983)

Phoenix

Department of Library Archives, and Public Records (unknown)
REGIONAL
Grand Canyon College Fleming Library (1978)
Phoenix Public Library (1917)
U.S. Court of Appeals 9th Circuit Library (1984)

Prescott

Yavapai College Library (1976)

Tempe

Arizona State University College of Law Library (1977)
Arizona State University Library (1944)

Tucson

Tucson Public Library (1970)
University of Arizona Library (1907) REGIONAL

Yuma

Yuma City-County Library (1963)

ARKANSAS

Arkadelphia

Ouachita Baptist University Riley Library (1963)

Batesville

Arkansas College Library (1963)

Clarksville

College of the Ozarks Dobson Memorial Library (1925)

Conway

Hendrix College Olin C. Bailey Library (1903)

Fayetteville

University of Arkansas Mullins Library (1907)
University of Arkansas School of Law Library (1978)

Little Rock

Arkansas State Library (1978) REGIONAL
Arkansas Supreme Court Library (1962)
Little Rock Public Library (1953)
University of Arkansas at Little Rock Library (1973)
University of Arkansas at Little Rock, School of Law Library (1979)

Magnolia

Southern Arkansas University Magale Library (1956)

Monticello

University of Arkansas at Monticello Library (1956)

Pine Bluff

University of Arkansas at Pine Bluff Watson Memorial Library (1976)

Russellville

Arkansas Tech University Tomlinson Library (1925)

Searcy

Harding University Beaumont Memorial Library (1963)

State University

Arkansas State University Dean B. Ellis Library (1913)

Walnut Ridge

Southern Baptist College Felix Goodson Library (1967)

CALIFORNIA

Anaheim

Anaheim Public Library (1963)

Arcadia

Arcadia Public Library (1975)

Arcata

Humboldt State University Library (1963)

Bakersfield

California State College Bakersfield Library (1974)
Kern County, Beale Memorial Library (1943)

Berkeley

University of California General Library (1907)
University of California Law Library (1963)

Carson

California State University Dominguez Hills Educational Resources
Center (1973)
Carson Regional Library (1973)

Chico

California State University Merriam Library (1962)

Claremont

Claremont Colleges' Libraries Honnold Library (1913)

Compton

Compton Public Library (1972)

Culver City

Culver City Library (1966)

Davis

University of California Shields Library (1953)
University of California at Davis Law Library (1972)

Downey

Downey City Library (1963)

Fresno

California State University, Fresno, Henry Madden Library (1962)
Fresno County Free Library (1920)

Fullerton

California State University at Fullerton Library (1963)
Western State University College of Law Library (1984)

Garden Grove

Garden Grove Regional Library (1963)

Gardena

Gardena Public Library (1966)

Hayward

California State University at Hayward Library (1963)

Huntington Park

Huntington Park Library (1970)

Inglewood

Inglewood Public Library (1963)

Irvine

University of California at Irvine General Library (1963)

La Jolla

University of California at San Diego Central University Library (1963)

Lakewood

Angelo Iacoboni Public Library (1970)

Lancaster

Lancaster Library (1967)

La Verne

University of La Verne College of Law Library (1979)

Long Beach

California State University at Long Beach Library (1962)
Long Beach Public Library (1933)

Los Angeles

California State University at Los Angeles John F. Kennedy Memorial
Library (1956)
Los Angeles County Law Library (1963)
Los Angeles Public Library (1891)
Loyola Marymount University Charles Von der Ahe Library (1933)
Loyola Law School Law Library (1979)
Occidental College Library (1941)
Southwestern University School of Law Library (1975)
University of California, University Research Library (1932)
University of California, Los Angeles Law Library (1958)
University of Southern California Doheny Memorial Library (1933)
University of Southern California Law Library (1978)
U.S. Court of Appeals 9th Circuit Library (1981)
Whittier College School of Law Library (1978)

Malibu

Pepperdine University Payson Library (1963)

Menlo Park

Department of Interior Geological Survey Library (1962)

Montebello

Montebello Regional Library (1966)

Monterey

U.S. Naval Postgraduate School Dudley Knox Library (1963)

Monterey Park

Bruggemeyer Memorial Library (1964)

Northridge

California State University at Northridge, Oviatt Library (1958)

Norwalk

Norwalk Regional Library (1973)

Oakland

Mills College Library (1966)
Oakland Public Library (1923)

Ontario

Ontario City Library (1974)

Palm Springs

Palm Springs Public Library (1980)

Pasadena

California Institute of Technology Millikan Memorial Library (1933)
Pasadena Public Library (1963)

Pleasant Hill

Contra Costa County Library (1964)

Redding

Shasta County Library (1956)

Redlands

University of Redlands Armacost Library (1933)

Redwood City

Redwood City Public Library (1966)

Reseda

West Valley Regional Branch Library (1966)

Richmond

Richmond Public Library (1943)

Riverside

Riverside City and County Public Library (1947)
University of California at Riverside Library (1963)

Sacramento

California State Library (1895) REGIONAL
California State University at Sacramento Library (1963)
Sacramento County Law Library (1963)
Sacramento Public Library (1880)
University of the Pacific McGeorge School of Law Library (1978)

San Bernardino

San Bernardino County Law Library (1984)
San Bernardino County Library (1964)

San Diego

San Diego County Law Library (1973)

San Diego County Library (1966)
San Diego Public Library (1895)
San Diego State University Library (1962)
University of San Diego Kratter Law Library (1967)

San Francisco

Golden Gate University School of Law Library (1979)
Hastings College of Law Library (1972)
San Francisco Public Library (1889)
San Francisco State University J. Paul Leonard Library (1955)
Supreme Court of California Library (1979)
U.S. Court of Appeals Ninth Circuit Library (1971)
University of San Francisco Richard A. Gleeson Library (1963)

San Jose

San Jose State University Library (1962)

San Leandro

San Leandro Community Library Center (1961)

San Luis Obispo

California Polytechnic State University Robert E. Kennedy Library (1969)

San Mateo

College of San Mateo Library (1987)

San Rafael

Marin County Free Library (1975)

Santa Ana

Orange County Law Library (1975)
Santa Ana Public Library (1959)

Santa Barbara

University of California at Santa Barbara Library (1960)

Santa Clara

University of Santa Clara Orradre Library (1963)

Santa Cruz

University of California at Santa Cruz McHenry Library (1963)

Santa Rosa

Sonoma County Library (1896)

Stanford

Stanford University Libraries (1895)
Stanford University Robert Crown Law Library (1978)

Stockton

Public Library of Stockton and San Joaquin County (1884)

Thousand Oaks

California Lutheran College Library (1964)

Torrance

Torrance Public Library (1969)

Turlock

California State University Stanislaus Library (1964)

Vallejo

Solano County Library John F. Kennedy Library (1982)

Valencia

Valencia Regional Library (1972)

Ventura

Ventura County Library Services Agency (1975)

Visalia

Tulare County Free Library (1967)

Walnut

Mount San Antonio College Educational Resources Library Center (1966)

West Covina

West Covina Regional Library (1966)

Whittier

Whittier College Wardman Library (1963)

COLORADO

Alamosa

Adams State College Library (1963)

Aurora

Aurora Public Library (1984)

Boulder

University of Colorado at Boulder Norlin Library (1879) REGIONAL

Colorado Springs

Colorado College Tutt Library (1880)
University of Colorado at Colorado Springs Library (1974)
U.S. Air Force Academy Library (1956)

Denver

Auraria Library (1978)
Colorado State Library (unknown)
Colorado Supreme Court Library (1978)
Denver Public Library (1884) REGIONAL
Department of the Interior Library (1962)
Regis College Dayton Memorial Library (1915)
U.S. Court of Appeals Tenth Circuit Library (1973)
University of Denver Penrose Library (1909)
University of Denver College of Law Westminster Law Library (1978)

Fort Collins

Colorado State University Libraries (1907)

Golden

Colorado School Mines Arthur Lakes Library (1939)

Grand Junction

Mesa College Lowell Heiny Library (1978)
Mesa County Public Library (1975)

Greeley

University of Northern Colorado James A. Michener Library (1966)

Gunnison

Western State College Leslie J. Savage Library (1932)

La Junta

Otero Junior College Wheeler Library (1963)

Lakewood

Jefferson County Public Library Lakewood Library (1968)

Pueblo

Pueblo Library District (1893)
University of Southern Colorado Library (1965)

CONNECTICUT

Bridgeport

Bridgeport Public Library (1884)
University of Bridgeport School of Law Library Wahlstrom Library (1979)

Danbury

Western Connecticut State University Ruth A. Haas Library (1967)

Danielson

Quinebaug Valley Community College Audrey P. Beck Library (1975)

Enfield

Enfield Central Library (1967)

Hartford

Connecticut State Library (unknown) REGIONAL
Hartford Public Library (1945)
Trinity College Library (1895)
University of Connecticut School of Law Library (1978)

Middletown

Wesleyan University Olin Library (1906)

Mystic

Mystic Seaport Museum, Inc., G. W. Blunt White Library (1964)

New Britain

Central Connecticut State University Elihu Burritt Library (1973)

New Haven

Southern Connecticut State University Hilton C. Buley Library (1968)
Yale Law Library (1981)
Yale University Seeley G. Mudd Library (1859)

New London

Connecticut College C. E. Shain Library (1926)
U.S. Coast Guard Academy Library (1939)

Stamford

Ferguson Library (1973)

Storrs

University of Connecticut Homer Babbidge Library (1907)

Waterbury

Post College Traurig Library (1977)
Silas Bronson Public Library (1869)

West Haven

University of New Haven Peterson Library (1971)

DELAWARE

Dover

Delaware State College William C. Jason Library (1962)
State Law Library in Kent County (unknown)

Georgetown

Delaware Technical and Community College Library (1968)
Sussex County Law Library (1976)

Newark

University of Delaware Library (1907)

Wilmington

Delaware Law School Library (1976)
New Castle County Law Library (1974)

DISTRICT OF COLUMBIA

Washington

Administrative Conference of the United States Library (1972)
Advisory Commission on Intergovernmental Relations Library (1977)
American University Washington College of Law Library (1983)
Catholic University of America Robert J. White Law Library (1979)
Comptroller of the Currency Library (1986)
Department of the Army Pentagon Library ANRAL (1969)
Department of Commerce Library (1955)
Department of Health and Human Services Library (1954)
Department of Housing and Urban Development Library (1969)
Department of the Interior Library Natural Resources Library (1895)
Department of Justice Main Library (1895)
Department of Labor Library (1976)
Department of the Navy Library (1895)
Department of State Library (1895)
Department of State Law Library (1966)
Department of Transportation Main Library (1982)
Department of Transportation, U.S. Coast Guard Law Library (1982)
Department of the Treasury Library (1895)
District of Columbia Court of Appeals Library (1981)
District of Columbia Public Library (1943)
Equal Employment Opportunity Commission Library (1984)
Executive Office of the President, Office of Administration, Library & Information Service Division (1965)
Federal Deposit Insurance Corporation Library (1972)
Federal Election Commission Law Library (1975)
Federal Energy Regulatory Commission Library (1983)
Federal Labor Relations Authority Law Library (1982)
Federal Mine Safety & Health Review Commission Library (1979)
Federal Reserve System Board of Governors Research Library (1978)
Federal Reserve System Law Library (1976)
General Accounting Office Technical Library (1974)
General Services Administration Library (1975)
Georgetown University Library (1969)
Georgetown University Law Center Fred O. Dennis Law Library (1978)
George Washington University Melvin Gelman Library (1983)
George Washington University National Law Center Jacob Burns Law Library (1978)
Library of Congress Congressional Research Service (1978)
Library of Congress Serial and Government Publications (1977)
Merit Systems Protection Board Library (1979)
National Defense University Library (1895)
Pension Benefit Guaranty Corporation Legal Dept. Library (1984)
U.S. Court of Appeals Judges' Library (1975)
U.S. Court of Appeals for the Federal Circuit Library (1986)
U.S. Information Agency Library (1984)
U.S. Office of Personnel Management Library (1963)
U.S. Postal Service Library (1895)
U.S. Senate Library (1979)
U.S. Supreme Court Library (1978)
University of the District of Columbia Library (1970)
Veterans' Administration Central Office Library (1967)

FLORIDA

Boca Raton

Florida Atlantic University S. E. Wimberly Library (1963)

Clearwater

Clearwater Public Library (1972)

Coral Gables

University of Miami Library Otto G. Richter Library (1939)

Daytona Beach

Volusia County Library Center (1963)

De Land

Stetson University duPont-Ball Library (1887)

Fort Lauderdale

Broward County Main Library (1967)
Nova University, Center for Study of Law/Law Library (1967)

Fort Pierce

Indian River Community College Library (1975)

Gainesville

University of Florida College of Law Library (1978)
University of Florida Libraries (1907) REGIONAL

Jacksonville

Haydon Burns Public Library (1914)
Jacksonville University Swisher Library (1962)
University of North Florida Thomas G. Carpenter Library (1972)

Lakeland

Lakeland Public Library (1928)

Leesburg

Lake-Sumter Community College Library (1963)

Melbourne

Florida Institute of Technology Library (1963)

Miami

Florida International University Library Tamiami Campus (1970)
Miami-Dade Public Library (1952)

North Miami

Florida International University North Miami Campus Library (1977)

Opa Locka

St. Thomas University Library (1977)

Orlando

University of Central Florida Library (1966)

Palatka

Saint Johns River Community College Library (1963)

Panama City

Bay County Public Library (1983)

Pensacola

University of West Florida John C. Pace Library (1966)

Port Charlotte

Charlotte County Library System (1973)

Saint Petersburg

Saint Petersburg Public Library (1965)
Stetson University College of Law Charles A. Dana Library (1975)

Sarasota

Selby Public Library (1970)

Tallahassee

Florida Agricultural and Mechanical University Coleman Memorial Library (1936)
Florida State University College of Law Library (1978)
Florida State University Strozier Library (1941)
Florida Supreme Court Library (1974)
State Library of Florida (1929)

Tampa

Tampa-Hillsborough County Public Library (1965)
University of South Florida Library (1962)
University of Tampa Merl Kelce Library (1953)

Winter Park

Rollins College Olin Library (1909)

GEORGIA

Albany

Dougherty County Public Library (1964)

Americus

Georgia Southwestern College James Earl Carter Library (1966)

Athens

University of Georgia Libraries (1970) REGIONAL
University of Georgia School of Law Library (1979)

Atlanta

Atlanta-Fulton Public Library (1880)
Atlanta University Center Robert W. Woodruff Library (1962)
Emory University School of Law Library (1968)
Emory University Woodruff Library (1928)
Georgia Institute of Technology Price Gilbert Memorial Library (1963)
Georgia State Library (unknown)
Georgia State University William Russell Pullen Library (1970)
Georgia State University College of Law Library (1983)
U.S. Court of Appeals 11th Circuit Library (1980)

Augusta

Augusta College Reese Library (1962)
Medical College of Georgia Library (1986)

Brunswick

Brunswick-Glynn County Regional Library (1965)

Carrollton

West Georgia College Irvine Sullivan Ingram Library (1962)

Columbus

Columbus College Simon Schwob Memorial Library (1975)

Dahlonega

North Georgia College Stewart Library (1939)

Dalton

Dalton Junior College Library (1978)

Macon

Mercer University Stetson Memorial Library (1964)
Mercer University Walter F. George School of Law Library (1978)

Marietta

Kennesaw College Library (1968)

Milledgeville

Georgia College Ina Dillard Russell Library (1950)

Mount Berry

Berry College Memorial Library (1970)

Savannah

Chatham-Effingham Liberty Regional Library (1857)

Statesboro

Georgia Southern College Zoah S. Henderson Library (1939)

Valdosta

Valdosta State College Library (1956)

GUAM

Agana

Nieves M. Flores Memorial Library (1962)

Mangilao

University of Guam Robert F. Kennedy Memorial Library (1978)

HAWAII

Hilo

University of Hawaii at Hilo Edwin H. Mookini Library (1962)

Honolulu

Hawaii Medical Library Incorporated (1968)
Hawaii State Library (1929)
Municipal Reference & Records Center (1965)
Supreme Court Law Library (1973)
University of Hawaii Hamilton Library (1907) REGIONAL
University of Hawaii William S. Richardson School of Law Library (1978)

Laie

Brigham Young University Hawaii Campus, Joseph F. Smith Library (1964)

Lihue

Kauai Regional Library (1967)

Pearl City

Leeward Community College Library (1967)

Wailuku

Maui Public Library (1962)

IDAHO

Boise

Boise Public Library and Information Center (1929)
Boise State University Library (1966)
Idaho State Law Library (unknown)
Idaho State Library (1971)

Caldwell

College of Idaho Terteling Library (1930)

Moscow

University of Idaho College of Law Library (1978)
University of Idaho Library (1907) REGIONAL

Nampa

Northwest Nazarene College John E. Riley Library (1984)

Pocatello

Idaho State University Eli Oboler Library (1908)

Rexburg

Ricks College Davis O. McKay Learning Resources Center (1946)

Twin Falls

College of Southern Idaho Library (1970)

ILLINOIS

Bloomington

Illinois Wesleyan University Sheean Library (1964)

Carbondale

Southern Illinois University at Carbondale Morris Library (1932)
Southern Illinois University School of Law Library (1978)

Carlinville

Blackburn College Lumpkin Library (1954)

Cartersville

Shawnee Library System (1971)

Champaign

University of Illinois Law Library (1965)

Charleston

Eastern Illinois University Booth Library (1962)

Chicago

Chicago Public Library (1876)
Chicago State University Paul and Emily Douglas Library (1954)
DePaul University Law Library (1979)
Field Museum of Natural History Library (1963)
Illinois Institute of Technology Chicago-Kent College of Law Library (1978)
Illinois Institute of Technology Paul V. Galvin Library (1982)
John Marshall Law School Library (1981)
Loyola University of Chicago E. M. Cudahy Memorial Library (1966)
Loyola University School of Law Library (1979)
Northeastern Illinois University Library (1961)
Northwestern University School of Law Library (1978)
University of Chicago Law Library (1964)
University of Chicago Library (1897)
University of Illinois at Chicago Library (1957)
William J. Campbell Library of the U.S. Courts (1979)

Decatur

Decatur Public Library (1954)

De Kalb

Northern Illinois University Founders' Memorial Library (1960)
Northern Illinois University College of Law Library (1978)

Des Plaines

Oakton Community College Library (1976)

Edwardsville

Southern Illinois University Lovejoy Memorial Library (1959)

Elsah

Principia College Marshall Brooks Library (1957)

Evanston

Northwestern University Library (1876)

Freeport

Freeport Public Library (1905)

Galesburg

Galesburg Public Library (1896)

Jacksonville

MacMurray College Henry Pfeiffer Library (1929)

Kankakee

Olivet Nazarene College Benner Library and Learning Resource Center (1946)

Lake Forest

Lake Forest College Donnelley Library (1962)

Lebanon

McKendree College Holman Library (1968)

Lisle

Illinois Benedictine College Theodore F. Lownik Library (1911)

Macomb

Western Illinois University Government Publications & Legal Reference Library (1962)

Moline

Black Hawk College Learning Resources Center (1970)

Monmouth

Monmouth College Hewes Library (1860)

Mount Carmel

Wabash Valley College Bauer Media Center (1975)

Mount Prospect

Mount Prospect Public Library (1977)

Normal

Illinois State University Milner Library (1877)

Oak Park

Oak Park Public Library (1963)

Oglesby

Illinois Valley Community College Jacobs Memorial Library (1976)

Palos Hills

Moraine Valley Community College Learning Resources Center (1972)

Peoria

Bradley University Cullom-Davis Library (1963)
Peoria Public Library (1883)

River Forest

Rosary College Library Rebecca Crown Library (1966)

Rockford

Rockford Public Library (1895)

Romeoville

Lewis University Library (1952)

Springfield

Illinois State Library (unknown) REGIONAL

Streamwood

Poplar Creek Public Library (1980)

University Park

Governors' State University Library (1974)

Urbana

University of Illinois Documents Library (1907)

Wheaton

Wheaton College Buswell Memorial Library (1964)

Woodstock

Woodstock Public Library (1963)

INDIANA

Anderson

Anderson College Charles E. Wilson Library (1959)
Anderson Public Library (1983)

Bloomington

Indiana University Library (1881)
Indiana University Law Library (1978)

Crawfordsville

Wabash College Lilly Library (1906)

Evansville

Evansville and Vanderburgh County Public Library (1928)
University of Southern Indiana Library (1969)

Fort Wayne

Allen County Public Library (1896)
University of Southern Indiana Library (1969)

Franklin

Franklin College Library (1976)

Gary

Gary Public Library (1943)
Indiana University Northwest Library (1966)

Greencastle

De Pauw University Roy O. West Library (1879)

Hammond

Hammond Public Library (1964)

Hanover

Hanover College Duggan Library (1892)

Huntington

Huntington College Loew Alumni Library (1964)

Indianapolis

Butler University Irwin Library (1965)
Indianapolis-Marion County Public Library (1906)
Indiana State Library (unknown) REGIONAL
Indiana Supreme Court Law Library (1975)
Indiana University School of Law Library (1967)
Indiana University-Purdue University Library (1979)

Kokomo

Indiana University at Kokomo Learning Resource Center (1969)

Muncie

Ball State University Alexander M. Bracken Library (1959)
Muncie Public Library (1906)

New Albany

Indiana University Southeast Library (1965)

Notre Dame

Notre Dame Law School Library (1985)
University of Notre Dame Memorial Library (1883)

Rensselaer

Saint Joseph's College Library (1964)

Richmond

Earlham College Lilly Library (1964)
Morrison-Reeves Library (1906)

South Bend

Indiana University at South Bend Library (1965)

Terre Haute

Indiana State University Cunningham Memorial Library (1906)

Valparaiso

Valparaiso University Moellering Memorial Library (1930)
Valparaiso University Law Library (1978)

West Lafayette

Purdue University Libraries (1907)

IOWA

Ames

Iowa State University Library (1907)

Cedar Falls

University of Northern Iowa Library (1946)

Cedar Rapids

Cedar Rapids Public Library (1986)

Council Bluffs

Free Public Library (1885)
Iowa Western Community College Herbert Hoover Library (1972)

Davenport

Davenport Public Library (1973)

Des Moines

Drake University Cowles Library (1966)
Drake University Law Library (1972)
Public Library of Des Moines (1888)
State Library of Iowa (unknown)

Dubuque

Carnegie-Stout Public Library (unknown)
Loras College Wahlert Memorial Library (1967)

Fayette

Upper Iowa University Henderson-Wilder Library (1974)

Grinnell

Grinnell College Burling Library (1874)

Iowa City

University of Iowa College of Law Law Library (1968)
University of Iowa Libraries (1884) REGIONAL

Lamoni

Graceland College Frederick Madison Smith Library (1927)

Mason City

North Iowa Area Community College Library (1976)

Mount Vernon

Cornell College Russell D. Cole Library (1896)

Orange City

Northwestern College Ramaker Library (1970)

Sioux City

Sioux City Public Library (1894)

KANSAS

Atchison

Benedictine College Library (1965)

Baldwin City

Baker University Collins Library (1908)

Colby

Colby Community College H. F. Davis Memorial Library (1968)

Emporia

Emporia State University William Allen White Library (1909)

Hays

Fort Hays State University Forsyth Library (1926)

Hutchinson

Hutchinson Public Library (1963)

Lawrence

University of Kansas Law Library (1971)
University of Kansas Spencer Research Library (1869) REGIONAL

Manhattan

Kansas State University Farrell Library (1907)

Pittsburg

Pittsburg State University Leonard H. Axe Library (1952)

Salina

Kansas Wesleyan University Memorial Library (1930)

Shawnee Mission

Johnson County Library (1979)

Topeka

Kansas State Historical Society Library (1877)
Kansas State Library (unknown)
Kansas Supreme Court Law Library (1975)
Washburn University of Topeka Law Library (1971)

Wichita

Wichita State University Ablah Library (1901)

KENTUCKY

Ashland

Boyd County Public Library (1946)

Barbourville

Union College Abigail E. Weeks Memorial Library (1958)

Bowling Green

Western Kentucky University Helm-Cravens Library (1934)

Crestview Hills

Thomas More College Library (1970)

Danville

Centre College Grace Doherty Library (1884)

Frankfort

Kentucky Department of Libraries and Archives (1967)
Kentucky State Law Library (unknown)
Kentucky State University Blazer Library (1972)

Highland Heights

Northern Kentucky University W. Frank Steely Library (1973)

Lexington

University of Kentucky Law Library (1968)
University of Kentucky Libraries (1907) REGIONAL

Louisville

Louisville Free Public Library (1904)
University of Louisville Ekstrom Library (1925)
University of Louisville Law Library (1975)

Morehead

Morehead State University Camden-Carroll Library (1955)

Murray

Murray State University Waterfield Library (1924)

Owensboro

Kentucky-Wesleyan College Library Learning Center (1966)

Richmond

Eastern Kentucky University John Grant Crabbe Library (1966)

LOUISIANA

Baton Rouge

Louisiana State Library (1976)
Louisiana State University Middleton Library (1907) REGIONAL
Louisiana State University Paul M. Hebert Law Center Library (1929)
Southern University Law School Library (1979)
Southern University Library (1952)

Eunice

Louisiana State University at Eunice LeDoux Library (1969)

Hammond

Southeastern Louisiana University Sims Memorial Library (1966)

Lafayette

University of Southwestern Louisiana Library (1938)

Lake Charles

McNeese State University Lether E. Frazar Memorial Library (1941)

Monroe

Northeast Louisiana University Sandel Library (1963)

Natchitoches

Northwestern State University of Louisiana Watson Memorial Library (1887)

New Orleans

Law Library of Louisiana (unknown)
Loyola University Library (1942)
Loyola University Law Library (1978)
New Orleans Public Library (1883)
Our Lady of Holy Cross College Library (1968)
Southern University in New Orleans Leonard S. Washington Memorial Library (1962)
Tulane University Law Library (1976)
Tulane University Howard-Tilton Memorial Library (1942)
U.S. Court of Appeals Fifth Circuit Library (1973)
University of New Orleans Earl K. Long Library (1963)

Pineville

Louisiana College Richard W. Norton Memorial Library (1969)

Ruston

Louisiana Technical University Prescott Memorial Library (1896)
REGIONAL

Shreveport

Louisiana State University at Shreveport Library (1967)
Shreve Memorial Library (1923)

Thibodaux

Nicholls State University Ellender Memorial Library (1962)

MAINE

Augusta

Maine Law and Legislative Reference Library (1973)
Maine State Library (unknown)

Bangor

Bangor Public Library (1884)

Brunswick

Bowdoin College Library (1884)

Castine

Maine Maritime Academy Nutting Memorial Library (1969)

Lewiston

Bates College George and Helen Ladd Library (1883)

Orono

University of Maine Raymond H. Fogler Library (1907) REGIONAL

Portland

Portland Public Library (1884)
University of Maine School of Law Garbrecht Law Library (1964)

Presque Isle

University of Maine at Presque Isle Library Learning Resources Center (1979)

Sanford

Louis B. Goodall Memorial Library (1984)

Waterville

Colby College Miller Library (1884)

MARYLAND

Annapolis

Maryland State Law Library (unknown)
U.S. Naval Academy Nimitz Library (1895)

Baltimore

Enoch Pratt Free Library (1887)
Johns Hopkins University Milton S. Eisenhower Library (1882)
Morgan State University Soper Library (1940)
University of Baltimore Langsdale Library (1973)
University of Baltimore Law Library (1980)
University of Maryland School of Law Marshall Law Library (1969)
U.S. Court of Appeals 4th Circuit Library (1982)

Bel Air

Harford Community College Library (1967)

Beltsville

Department of Agriculture National Agricultural Library (1895)

Bethesda

Department of Health and Human Services National Library of Medicine (1978)
Uniformed Services University of Health Sciences Learning Resource Center (1983)

Catonsville

University of Maryland Baltimore County Albin O. Kuhn Library & Gallery (1971)

Chestertown

Washington College Clifton M. Miller Library (1891)

College Park

University of Maryland McKeldin Library (1925) REGIONAL

Cumberland

Allegany Community College Library (1974)

Frostburg

Frostburg State College Library (1967)

Patuxent River

Patuxent River Central Library (1968)

Rockville

Montgomery County Department of Public Libraries (1951)

Salisbury

Salisbury State College Blackwell Library (1965)

Towson

Goucher College Julia Rogers Library (1966)
Towson State University Cook Library (1979)

Westminster

Western Maryland College Hoover Library (1886)

MASSACHUSETTS

Amherst

Amherst College Library (1884)
University of Massachusetts University Library (1907)

Boston

Boston Athenaeum Library (unknown)
Boston Public Library (1859) REGIONAL
Boston University School of Law Pappas Law Library (1979)
Northeastern University Dodge Library (1962)
State Library of Massachusetts (unknown)
Suffolk University Law Library (1979)
Supreme Judicial Court Social Law Library (1979)
U.S. Court of Appeals First Circuit Library (1978)

Brookline

Public Library of Brookline (1925)

Cambridge

Harvard College Library (1860)
Harvard Law School Library (1981)
Massachusetts Institute of Technology Library (1946)

Chicopee

College of Our Lady of the Elms Alumnae Library (1969)

Lowell

University of Lowell Alumni-Lydon Library (1952)

Lynn

Lynn Public Library (1963)

Medford

Tufts University Wessel Library (1899)

Milton

Curry College Levin Library (1972)

New Bedford

New Bedford Free Public Library (1858)

Newton

Boston College Thomas P. O'Neill Jr. Library (1963)

Newton Centre

Boston College Law School Library (1979)

North Dartmouth

Southeastern Massachusetts University Library (1965)

North Easton

Stonehill College Cushing-Martin Library (1962)

Springfield

Springfield City Library (1966)
Western New England College Law Library (1978)

Waltham

Brandeis University Library (1965)
Waltham Public Library (1982)

Wellesley

Wellesley College Library (1943)

Wenham

Gordon College Winn Library (1963)

Williamstown

William College Library (unknown)

Worcester

American Antiquarian Society Library (1814)
University of Massachusetts Medical Center Lamar Soutter Library (1972)
Worcester Public Library (1859)

MICHIGAN

Albion

Albion College Stockwell Memorial Library (1966)

Allendale

Grand Valley State College Zumberge Library (1963)

Alma

Alma College Library (1963)

Ann Arbor

University of Michigan Harlan Hatcher Graduate Library (1884)

University of Michigan Law Library (1978)

Benton Harbor

Benton Harbor Public Library (1907)

Bloomfield Hills

Cranbrook Institute of Science Library (1940)

Dearborn

Henry Ford Centennial Library (1969)

Henry Ford Community College Library (1957)

Detroit

Detroit College of Law Library (1979)

Detroit Public Library (1868) REGIONAL

Marygrove College Library (1965)

Mercy College of Detroit Library (1965)

University of Detroit Library (1884)

University of Detroit School of Law Library (1978)

Wayne State University G. Flint Purdy Library (1937)

Wayne State University Arthur Neef Law Library (1971)

Dowagiac

Southwestern Michigan College Matthews Library (1971)

East Lansing

Michigan State University Documents Library (1907)

Farmington Hills

Oakland Community College Martin L. King Learning Resources Center (1968)

Flint

Flint Public Library (1967)

University of Michigan-Flint Library (1977)

Grand Rapids

Calvin College & Seminary Library (1967)

Grand Rapids Public Library (1876)

Houghton

Michigan Technological University Library (1876)

Jackson

Jackson District Library (1965)

Kalamazoo

Kalamazoo Public Library (1907)

Western Michigan University Dwight B. Waldo Library (1963)

Lansing

Library of Michigan (unknown) REGIONAL

Thomas M. Cooley Law School Library (1978)

Livonia

Schoolcraft College Library (1962)

Madison Heights

Madison Heights Public Library (1982)

Marquette

Northern Michigan University Olson Library (1963)

Monroe

Monroe County Library System (1974)

Mount Clemens

Macomb County Library (1968)

Mount Pleasant

Central Michigan University Library (1958)

Muskegon

Hackley Public Library (1894)

Olivet

Olivet College Library (1974)

Petoskey

North Central Michigan College Library (1962)

Port Huron

Saint Clair County Library (1876)

Rochester

Oakland University Kresge Library (1964)

Royal Oak

Royal Oak Public Library (1984)

Saginaw

Hoyt Public Library (1890)

Sault Ste. Marie

Lake Superior State College Kenneth Shouldice Library (1982)

Traverse City

Northwestern Michigan College Mark Osterlin Library (1964)

University Center

Delta College Learning Resources Center (1963)

Warren

Warren Public Library Arthur J. Miller Branch (1973)

Wayne

Wayne Oakland Library Federation (1957)

Ypsilanti

Eastern Michigan University Library (1965)

MICRONESIA

Community College of Micronesia Library (1982)

MINNESOTA

Bemidji

Bemidji State University A.C. Clark Library (1963)

Blaine

Anoka County Library (1971)

Collegeville

Saint John's University Alcuin Library (1954)

Cottage Grove

Washington County Library-Park Grove (1983)

Duluth

Duluth Public Library (1909)
University of Minnesota Duluth Library (1984)

Eagan

Dakota County Eagan Library (1983)

Edina

Southdale-Hennepin Area Library (1971)

Mankato

Mankato State University Library (1962)

Marshall

Southwest State University Library (1986)

Minneapolis

Minneapolis Public Library (1893)
University of Minnesota Law School Library (1978)
University of Minnesota Wilson Library (1907) REGIONAL

Moorhead

Moorhead State University Livingston Lord Library (1956)

Morris

University of Minnesota, Morris, Rodney A. Briggs Library (1963)

Northfield

Carleton College Library (1930)
Saint Olaf College Rolvaag Memorial Library (1930)

Saint Cloud

Saint Cloud State University Learning Resources Center (1962)

Saint Paul

Hamline University School of Law Library (1978)
Minnesota Historical Society Library (1867)
Minnesota State Law Library (unknown)
Saint Paul Public Library (1914)
University of Minnesota Saint Paul Campus Library (1974)
William Mitchell College of Law Library (1979)

Saint Peter

Gustavus Adolphus College Library (1941)

Winona

Winona State University Maxwell Library (1969)

MISSISSIPPI

Cleveland

Delta State University W. B. Roberts Library (1975)

Columbus

Mississippi University for Women John Clayton Fant Memorial Library (1929)

Hattiesburg

University of Southern Mississippi Joseph A. Cook Memorial Library (1935)

Jackson

Jackson State University Henry Thomas Sampson Library (1968)
Millsaps College Millsaps-Wilson Library (1963)
Mississippi College School of Law Library (1977)
Mississippi Library Commission (1947)
Mississippi State Law Library (unknown)

Lorman

Alcorn State University Library (1970)

Mississippi State

Mississippi State University Mitchell Memorial Library (1907)

Pascagoula

Jackson-George Regional Library (1985)

University

University of Mississippi J. D. Williams Library (1883) REGIONAL
University of Mississippi James O. Eastland Law Library (1967)

MISSOURI

Cape Girardeau

Southeast Missouri State University Kent Library (1916)

Columbia

University of Missouri at Columbia Library (1862) REGIONAL
University of Missouri-Columbia Law Library (1978)

Fayette

Central Methodist College George M. Smiley Memorial Library (1962)

Fulton

Westminster College Reeves Library (1875)

Hillsboro

Jefferson College Library (1984)

Jefferson City

Lincoln University Inman E. Page Library (1944)
Missouri State Library (1963)
Missouri Supreme Court Library (unknown)

Joplin

Missouri Southern State College Library (1966)

Kansas City

Kansas City Missouri Public Library (1881)
Rockhurst College Greenlease Library (1917)
University of Missouri at Kansas City General Library (1938)
University of Missouri-Kansas City Leon E. Bloch Law Library (1978)

Kirksville

Northeast Missouri State University Pickler Memorial Library (1966)

Liberty

William Jewell College Charles F. Curry Library (1900)

Maryville

Northwest Missouri State University B. D. Owens Library (1982)

Rolla

University of Missouri-Rolla Curtis Laws Wilson Library (1907)

Saint Charles

Lindenwood College Margaret Leggat Butler Library (1973)

Saint Joseph

Saint Joseph Public Library (1891)

Saint Louis

Marysville College Library (1976)
Saint Louis County Library (1970)
Saint Louis Public Library (1866)
Saint Louis University Law Library (1967)
Saint Louis University Pius XII Memorial Library (1866)
U.S. Court of Appeals Eighth Circuit Library (1972)
University of Missouri at Saint Louis Thomas Jefferson Library (1966)
Washington University John M. Olin Library (1906)
Washington University Law Library (1978)

Springfield

Drury College, Walker Library (1874)
Southwest Missouri State University Library (1963)

Warrensburg

Central Missouri State University Ward Edwards Library (1914)

MONTANA

Billings

Eastern Montana College Library (1958)

Bozeman

Montana State University Renne Library (1907)

Butte

Montana College of Mineral Science and Technology Library (1901)

Havre

Northern Montana College Vande Bogart Library (1980)

Helena

Carroll College Library (1974)
Montana State Library (1966)
State Law Library of Montana (1977)

Missoula

University of Montana Maurene & Mike Mansfield Library (1909)
REGIONAL

NEBRASKA

Blair

Dana College Dana-LIFE Library (1924)

Crete

Doane College Perkins Library (1944)

Fremont

Midland Lutheran College Luther Library (1924)

Kearney

Kearney State College Calvin T. Ryan Library (1962)

Lincoln

Nebraska Library Commission (1972)
Nebraska State Library (unknown)
University of Nebraska-Lincoln College of Law Library (1981)
University of Nebraska-Lincoln D. L. Love Memorial Library (1907)
REGIONAL

Omaha

Creighton University Reinert/Alumni Library (1964)
Creighton University School of Law Library (1979)
Omaha Public Library W. Dale Clark Library (1880)
University of Nebraska at Omaha University Library (1939)

Scottsbluff

Scottsbluff Public Library (1925)

Wayne

Wayne State College U.S. Conn Library (1970)

NEVADA

Carson City

Nevada State Library (unknown)
Nevada Supreme Court Library (1973)

Las Vegas

Las Vegas-Clark County Library (1974)
University of Nevada at Las Vegas James Dickinson Library (1959)

Reno

National Judicial College Law Library (1979)
Nevada Historical Society Library (1974)
University of Nevada-Reno Library (1907) REGIONAL
Washoe County Library (1980)

NEW HAMPSHIRE

Concord

Franklin Pierce Law Center Library (1973)
New Hampshire State Library (unknown)

Durham

University of New Hampshire Library (1907)

Hanover

Dartmouth College Library (1884)

Henniker

New England College Danforth Library (1966)

Manchester

Manchester City Library (1884)
New Hampshire College H. A. B. Shapiro Memorial Library (1976)
Saint Anselm College Geisel Library (1963)

Nashua

Nashua Public Library (1971)

NEW JERSEY

Bayonne

Bayonne Free Public Library (1909)

Bloomfield

Bloomfield Public Library (1965)

Bridgeton

Cumberland County Library (1966)

Camden

Rutgers University Camden Library (1966)
Rutgers University School of Law Library (1979)

Convent Station

College of Saint Elizabeth Mahoney Library (1938)

East Brunswick

East Brunswick Public Library (1977)

East Orange

East Orange Public Library (1966)

Elizabeth

Free Public Library of Elizabeth (1895)

Glassboro

Glassboro State College Savitz Learning Resource Center (1963)

Hackensack

Johnson Free Public Library (1966)

Irvington

Irvington Public Library (1966)

Jersey City

Jersey City Public Library (1879)
Jersey City State College Forrest A. Irwin Library (1963)

Lawrenceville

Rider College Franklin F. Moore Library (1975)

Madison

Drew University Library (1939)

Mahwah

Ramapo College Library (1971)

Mount Holly

Burlington County Library (1966)

New Brunswick

New Brunswick Free Public Library (1908)
Rutgers University Alexander Library (1907)

Newark

Newark Public Library (1906) REGIONAL
Rutgers-The State University of New Jersey John Cotton Dana Library (1966)
Rutgers University Law School, Ackerson Law Library (1979)
Seton Hall University Law Library (1979)

Newton

Sussex County Library (1986)

Passaic

Passaic Public Library (1964)

Phillipsburg

Phillipsburg Free Public Library (1976)

Plainfield

Plainfield Public Library (1971)

Pomona

Stockton State College Library (1972)

Princeton

Princeton University Library (1884)

Randolph

County College of Morris Sherman H. Masten Learning Resource Center (1975)

Rutherford

Fairleigh Dickinson University Messler Library (1953)

Shrewsbury

Monmouth County Library (1968)

South Orange

Seton Hall University McLaughlin Library (1947)

Teaneck

Fairleigh Dickinson University Weiner Library (1963)

Toms River

Ocean County College Learning Resources Center (1966)

Trenton

New Jersey State Library (unknown)
Trenton Free Public Library (1902)

Union

Kean College of New Jersey Nancy Thompson Library (1971)

Upper Montclair

Montclair State College Harry A. Sprague Library (1967)

Wayne

Wayne Public Library (1972)

West Long Branch

Monmouth College Guggenheim Memorial Library (1963)

Woodbridge

Woodbridge Public Library (1965)

NEW MEXICO

Albuquerque

University of New Mexico Medical Center Library (1973)
University of New Mexico School of Law Library (1973)
University of New Mexico General Library (1896) REGIONAL

Hobbs

New Mexico Junior College Pannell Library (1969)

Las Cruces

New Mexico State University Library (1907)

Las Vegas

New Mexico Highlands University Donnelly Library (1913)

Portales

Eastern New Mexico University Golden Library (1962)

Santa Fe

New Mexico State Library (1960) REGIONAL
New Mexico Supreme Court Law Library (unknown)

Silver City

Western New Mexico University Miller Library (1972)

Socorro

New Mexico Institute of Mining & Technology Martin Speare Memorial Library (1984)

NEW YORK

Albany

Albany Law School Library (1979)
New York State Library (unknown) REGIONAL
State University of New York at Albany University Library (1964)

Auburn

Seymour Library (1972)

Binghamton

State University New York at Binghamton Glenn G. Bartle Library (1962)

Brockport

State University of New York at Brockport Drake Memorial Library (1967)

Bronx

Fordham University Library (1937)
Herbert H. Lehman College Library (1967)
New York Public Library (1973)
State University of New York Maritime College Stephen B. Luce Library (1947)

Bronxville

Sarah Lawrence College Esther Raushenbush Library (1969)

Brooklyn

Brooklyn College Library (1936)
Brooklyn Law School Library (1974)
Brooklyn Public Library (1908)
Brooklyn Public Library Business Library (1984)
Pratt Institute Library (1891)
State University of New York Downstate Medical Center Library (1958)

Buffalo

Buffalo and Erie County Public Library (1895)
State University of New York at Buffalo Charles B. Sears Law Library (1978)
State University of New York at Buffalo Lockwood Memorial Library (1963)

Canton

Saint Lawrence University Owen D. Young Library (1920)

Corning

Corning Community College Arthur A. Houghton Jr. Library (1963)

Cortland

State University of New York College at Cortland Memorial Library (1964)

Delhi

State University Agricultural and Technical College Library (1970)

East Islip

East Islip Public Library (1973)

Elmira

Elmira College Gannett Tripp Learning Center (1956)

Farmingdale

State University of New York at Farmingdale Greenley Library (1917)

Flushing

CUNY Law School at Queens College CUNY Law Library (1983)
Queens College Paul Klapper Library (1939)

Garden City

Adelphi University Swirbul Library (1966)

Geneseo

State University of New York at Geneseo Milne Library (1967)

Greenvale

Long Island University B. Davis Schwartz Memorial Library (1964)

Hamilton

Colgate University, Everett Needham Case Library (1902)

Hempstead

Hofstra University Library (1964)
Hofstra University School of Law Library (1979)

Huntington

Touro College School of Law Library (1985)

Ithaca

Cornell University Library (1907)
Cornell Law Library (1978)
New York State College of Agriculture and Human Ecology Albert R. Mann Library (1943)

Jamaica

Queens Borough Public Library (1926)
Saint John's University Library (1956)
Saint John's University School of Law Library (1978)

Kings Point

U.S. Merchant Marine Academy Schuyler Otis Bland Library (1962)

Long Island City

Fiorello H. LaGuardia Community College Library (1981)

Middletown

Thrall Library (1986)

Mount Vernon

Mount Vernon Public Library (1962)

New Paltz

State University College at New Paltz Sojourner Truth Library (1965)

New York City

City College of City University of New York Library (1884)
College of Insurance Library (1965)
Columbia University Libraries (1882)
Columbia University School of Law Library (1981)
Cooper Union for the Advancement of Science and Arts Library (1930)
Medical Library Center of New York (1976)
New York Law Institute Library (1909)
New York Law School Library (1979)
New York Public Library Astor Branch (1907)
New York Public Library Lenox Branch (1884)
New York University Law Library (1974)
New York University Elmer Holmes Bobst Library (1967)
U.S. Court of Appeals Second Circuit Library (1976)
Yeshiva University Chutick Law Library Cardozo School of Law (1979)
Yeshiva University Pollack Library (1979)

Newburgh

Newburgh Free Library (1909)

Niagara Falls

Niagara Falls Public Library (1976)

Oakdale

Dowling College Library (1965)

Oneonta

State University College at Oneonta James M. Milline Library (1966)

Oswego

State University of New York at Oswego Penfield Library (1966)

Plattsburgh

State University College at Plattsburgh Benjamin F. Feinberg Library (1967)

Potsdam

Clarkson University Harriet Call Burnap Memorial Library (1938)
State University College at Potsdam Frederick W. Crumb Memorial Library (1964)

Poughkeepsie

Vassar College Library (1943)

Purchase

State University of New York, College at Purchase Library (1969)

Rochester

Rochester Public Library (1963)
University of Rochester Rush Rhees Library (1880)

Saint Bonaventure

Saint Bonaventure University Friedsam Memorial Library (1938)

Saratoga Springs

Skidmore College Library (1964)

Schenectady

Union College Schaffer Library (1901)

Southampton

Long Island University Southampton Campus Library (1973)

Sparkill

St. Thomas Aquinas College Loughheed Library (1984)

Staten Island

Wagner College Horrmann Library (1953)

Stony Brook

State University of New York at Stony Brook Main Library (1963)

Syracuse

Onondaga County Public Library (1978)
Syracuse University Bird Library (1878)
Syracuse University College of Law H. Douglas Barclay Law Library (1978)

Troy

Troy Public Library (1869)

Uniondale

Nassau Library System (1965)

Utica

Utica Public Library (1885)
SUNY College of Technology Library (1977)

West Point

U.S. Military Academy Library (unknown)

White Plains

Pace University Law School Library (1978)

Yonkers

Yonkers Public Library Getty Square Branch (1910)

Yorktown Heights

Mercy College Library (1976)

NORTH CAROLINA

Asheville

University of North Carolina at Asheville D. Hiden Ramsey Library (1965)

Boiling Springs

Gardner-Webb College Dover Memorial Library (1974)

Boone

Appalachian State University Carol Grotnes Belk Library (1963)

Buies Creek

Campbell University Carrie Rich Memorial Library (1965)

Chapel Hill

University of North Carolina at Chapel Hill Davis Library (1884)
REGIONAL
University of North Carolina Law Library (1978)

Charlotte

Public Library of Charlotte and Mecklenburg County (1964)
Queens College Everett Library (1927)
University of North Carolina at Charlotte Atkins Library (1964)

Cullowhee

Western Carolina University Hunter Library (1953)

Davidson

Davidson College Library (1893)

Durham

Duke University School of Law Library (1978)
Duke University William R. Perkins Library (1890)
North Carolina Central University Law Library (1979)
North Carolina Central University James E. Shepard Memorial Library (1973)

Elon College

Elon College Iris Holt McEwen Library (1971)

Fayetteville

Fayetteville State University Charles W. Chesnutt Library (1971)

Greensboro

North Carolina Agricultural and Technical State University F. D. Bluford Library (1937)
University of North Carolina at Greensboro Walter Clinton Jackson Library (1963)

Greenville

East Carolina University J. Y. Joyner Library (1951)

Laurinburg

Saint Andrews Presbyterian College DeTamble Library (1969)

Lexington

Davidson County Public Library (1971)

Mount Olive

Mount Olive College Moye Library (1971)

Pembroke

Pembroke State University Mary H. Livermore Library (1956)

Raleigh

Department of Cultural Resources Division of State Library (unknown)
North Carolina State University D. H. Hill Library (1923)
North Carolina Supreme Court Library (1972)

Rocky Mount

North Carolina Wesleyan College Library (1969)

Salisbury

Catawba College Library (1925)

Wilmington

University of North Carolina at Wilmington William M. Randall Library (1965)

Wilson

Atlantic Cristian College Hackney Library (1930)

Winston-Salem

Forsyth County Public Library (1954)
Wake Forest University Z. Smith Reynolds Library (1902)

NORTH DAKOTA

Bismarck

North Dakota State Library (1971)
North Dakota Supreme Court Law Library (unknown)
State Historical Society of North Dakota State Archives & Historical Research Library (1907)
Veteran's Memorial Public Library (1967)

Dickinson

Dickinson State College Stoxen Library (1968)

Fargo

Fargo Public Library (1964)
North Dakota State University Library (1907) REGIONAL

Grand Forks

University of North Dakota Chester Fritz Library (1890)

Minot

Minot State College Memorial Library (1925)

Valley City

Valley City State College Library (1913)

OHIO

Ada

Ohio Northern University J. P. Taggart Law Library (1965)

Akron

Akron-Summit County Public Library (1952)
University of Akron Bierce Library (1963)
University of Akron School of Law Library (1978)

Alliance

Mount Union College Library (1888)

Ashland

Ashland College Library (1938)

Athens

Ohio University Aiden Library (1886)

Batavia

University of Cincinnati at Batavia Clermont General and Technical College Library (1973)

Bluffton

Bluffton College, Musselman Library (1951)

Bowling Green

Bowling Green State University Jerome Library (1933)

Canton

Malone College Everett L. Cattell Library (1970)

Chardon

Geauga County Public Library (1971)

Cincinnati

Public Library of Cincinnati and Hamilton County (1884)
University of Cincinnati Central Library (1929)
University of Cincinnati College of Law (1978)
U.S. Court of Appeals 6th Circuit Library (1986)

Cleveland

Case Western Reserve University Freiburger Library (1913)
Case Western Reserve University School of Law Library (1979)
Cleveland Public Library (1886)
Cleveland State University Cleveland-Marshall College of Law Joseph
W. Bartunek III Law Library (1978)
Cleveland State University Library (1966)
Municipal Reference Library (1970)

Cleveland Heights

Cleveland Heights-University Heights Public Library (1970)

Columbus

Capital University Law School Library (1980)
Capital University Library (1968)
Ohio State University College of Law Library (1984)
Ohio State University Libraries (1907)
Ohio Supreme Court Law Library (1973)
Public Library of Columbus and Franklin County (1885)
State Library of Ohio (unknown) REGIONAL

Dayton

Dayton and Montgomery County Public Library (1909)
University of Dayton Roesch Library (1969)
Wright State University Library (1965)

Delaware

Ohio Wesleyan University L. A. Beeghly Library (1845)

Elyria

Elyria Public Library (1966)

Findlay

Findlay College Shafer Library (1969)

Gambier

Kenyon College Library (1873)

Granville

Denison University Libraries William H. Doane Library (1884)

Hiram

Hiram College Teachout-Price Memorial Library (1874)

Kent

Kent State University Libraries (1962)

Marietta

Marietta College Dawes Memorial Library (1884)

Marion

Marion Public Library (1979)

Middletown

Miami University-Middletown Gardner-Harvey Library (1970)

New Concord

Muskingum College Library (1966)

Oberlin

Oberlin College Library (1858)

Oxford

Miami University Libraries King Library (1909)

Portsmouth

Shawnee State University Library (1987)

Rio Grande

Rio Grande College and Community College Jeanette Albiez Davis
Library (1966)

Springfield

Warder Public Library (1884)

Steubenville

University of Steubenville Starvaggi Memorial Library (1971)
Public Library of Steubenville and Jefferson County (1950)

Tiffin

Heidelberg College Beeghly Library (1964)

Toledo

Toledo-Lucas County Public Library (1884)
University of Toledo College of Law Library (1981)
University of Toledo Library (1963)

University Heights

John Carroll University Grasselli Library (1963)

Westerville

Otterbein College Courtright Memorial Library (1967)

Wilmington

Wilmington College S. Arthur Watson Library (1986)

Wooster

College of Wooster Andrews Library (1966)

Worthington

Worthington Public Library (1984)

Youngstown

Public Library of Youngstown and Mahoning County (1923)
Youngstown State University William F. Maag Library (1971)

OKLAHOMA

Ada

East Central Oklahoma State University Linscheid Library (1914)

Alva

Northwestern Oklahoma State University J. W. Martin Library (1907)

Bethany

Southern Nazarene University R. T. Williams Learning Resources Center (1971)

Durant

Southeastern Oklahoma State University Henry G. Bennett Memorial Library (1929)

Edmond

Central State University Library (1934)

Enid

Public Library of Enid and Garfield County (1908)

Langston

Langston University G. Lamar Harrison Library (1941)

Norman

University of Oklahoma Libraries Bizzell Memorial Library (1893)
University of Oklahoma Law Library (1978)

Oklahoma City

Metropolitan Library System Main Library (1974)
Oklahoma City University Dulaney Browne Library (1963)
Oklahoma Department of Libraries (1893) REGIONAL

Shawnee

Oklahoma Baptist University Library (1933)

Stillwater

Oklahoma State University Library (1907) REGIONAL

Tahlequah

Northeastern Oklahoma State University John Vaughan Library (1923)

Tulsa

Tulsa City-County Library System (1963)
University of Tulsa College of Law Library (1979)
University of Tulsa McFarlin Library (1929)

Weatherford

Southwestern Oklahoma State University Al Harris Library (1958)

OREGON

Ashland

Southern Oregon State College Library (1953)

Bend

Central Oregon Community College Library/Media Service (1985)

Corvallis

Oregon State University Library (1907)

Eugene

University of Oregon Law Library (1979)
University of Oregon Library (1883)

Forest Grove

Pacific University Harvey W. Scott Memorial Library (1897)

Klamath Falls

Oregon Institute of Technology Library (1982)

La Grande

Eastern Oregon State College Walter M. Pierce Library (1954)

McMinnville

Linfield College Northup Library (1965)

Monmouth

Western Oregon State College Library (1967)

Pendleton

Blue Mountain Community College Library (1983)

Portland

Lewis and Clark College Aubrey R. Watzek Library (1967)
Library Association of Portland (1884)
Northwestern School of Law Lewis and Clark College Paul L. Boley Law Library (1979)
Portland State University Millar Library (1963) REGIONAL
Reed College Library (1912)
U.S Department of Energy Bonneville Power Administration Library (1962)

Salem

Oregon State Library (unknown)
Oregon Supreme Court Law Library (1974)
Willamette University College of Law Library (1979)
Willamette University Main Library (1969)

PENNSYLVANIA

Allentown

Muhlenberg College Haas Library (1939)

Altoona

Altoona Area Public Library (1969)

Bethel Park

Bethel Park Public Library (1980)

Bethlehem

Lehigh University Libraries Linderman Library (1876)

Blue Bell

Montgomery County Community College Learning Resources Center (1975)

Bradford

University of Pittsburgh at Bradford Bradford Campus Library (1979)

California

California University of Pennsylvania Louis L. Manderino Library (1986)

Carlisle

Dickinson College Boyd Lee Spahr Library (1947)
Dickinson School of Law Sheeley-Lee Law Library (1978)

Cheyney

Cheyney University Leslie Pinckney Hill Library (1967)

Collegeville

Ursinus College Myrin Library (1963)

Coraopolis

Robert Morris College Library (1978)

Doylestown

Bucks County Free Library (1970)

East Stroudsburg

East Stroudsburg University Kemp Library (1966)

Erie

Erie County Library System (1987)

Greenville

Thiel College Langenheim Memorial Library (1963)

Harrisburg

State Library of Pennsylvania (unknown) REGIONAL

Haverford

Haverford College Magill Library (1897)

Hazleton

Hazleton Area Public Library (1964)

Indiana

Indiana University of Pennsylvania Rhodes R. Stabley Library (1962)

Johnstown

Cambria County Library System Glosser Memorial Library Building (1965)

Lancaster

Franklin and Marshall College Shadek-Fackenthal Library (1895)

Lewisburg

Bucknell University Ellen Clarke Bertrand Library (1963)

Mansfield

Mansfield University Library (1968)

Meadville

Allegheny College Lawrence Lee Pelletier Library (1907)

Millersville

Millersville University Helen A. Ganser Library (1966)

Monessen

Monessen Public Library (1969)

New Castle

New Castle Public Library (1963)

Newtown

Bucks County Community College Library (1968)

Norristown

Montgomery County Norristown Public Library (1969)

Philadelphia

Drexel University Library (1963)
Free Library of Philadelphia (1897)
Saint Joseph's University Drexel Library (1974)
Temple University Paley Library (1947)
Temple University Law Library (1979)
Thomas Jefferson University Scott Memorial Library (1978)
U.S. Court of Appeals Third Circuit Library (1973)
University of Pennsylvania Biddle Law Library (1974)
University of Pennsylvania Library (1886)

Pittsburgh

Allegheny County Law Library (1977)
Carnegie Library of Pittsburgh (1895)
Carnegie Library of Pittsburgh Allegheny Regional Branch (1924)
Duquesne University Law Library (1978)
La Roche College John J. Wright Library (1974)
U.S. Bureau of Mines Library (1962)
University of Pittsburgh Hillman Library (1910)
University of Pittsburgh Law Library (1979)

Pottsville

Pottsville Free Public Library (1967)

Reading

Reading Public Library (1901)

Scranton

Scranton Public Library (1895)

Shippensburg

Shippensburg University Ezra Lehman Memorial Library (1973)

Slippery Rock

Slippery Rock University Bailey Library (1965)

Swarthmore

Swarthmore College McCabe Library (1923)

University Park

Pennsylvania State University Libraries Pattee Library (1907)

Villanova

Villanova University Law School Pulling Law Library (1964)

Warren

Warren Library Association Warren Public Library (1885)

Waynesburg

Waynesburg College Library (1964)

West Chester

West Chester University Francis Harvey Green Library (1967)

Wilkes-Barre

King's College D. Leonard Corgan Library (1949)

Williamsport

Lycoming College Library (1970)

York

York College of Pennsylvania Schmidt Library (1963)

Youngwood

Westmoreland County Community College Learning Resources Center
(1972)

PUERTO RICO

Mayaguez

University of Puerto Rico Mayaguez Campus Library (1928)

Ponce

Catholic University of Puerto Rico Encarnacion Valdes Library (1966)
Catholic University of Puerto Rico School of Law Library (1978)

Rio Piedras

University of Puerto Rico J. M. Lazaro Library (1928)

REPUBLIC OF PANAMA

Balboa Heights

Panama Canal Commission (1963)

RHODE ISLAND

Barrington

Barrington Public Library (1986)

Kingston

University of Rhode Island Library (1907)

Newport

U.S. Naval War College Library (1963)

Providence

Brown University John D. Rockefeller Jr. Library (unknown)
Providence College Phillips Memorial Library (1969)
Providence Public Library (1884)
Rhode Island College James P. Adams Library (1965)
Rhode Island State Law Library (1979)
Rhode Island State Library (1895)

Warwick

Warwick Public Library (1966)

Westerly

Westerly Public Library (1909)

Woonsocket

Woonsocket Harris Public Library (1977)

SOUTH CAROLINA

Charleston

Baptist College at Charleston L. Mendel Rivers Library (1967)
The Citadel Military College Daniel Library (1962)
College of Charleston Robert Scott Small Library (1869)

Clemson

Clemson University Cooper Library (1893)

Columbia

Benedict College Payton Learning Resources Center (1969)
South Carolina State Library (1895)
University of South Carolina Coleman Karesh Law Library (1983)
University of South Carolina Thomas Cooper Library (1884)

Conway

University of South Carolina Coastal Carolina College Kimbel Library (1974)

Due West

Erskine College McCain Library (1968)

Florence

Florence County Library (1967)
Francis Marion College James A. Rogers Library (1970)

Greenville

Furman University Library (1962)
Greenville County Library (1966)

Greenwood

Lander College Larry A. Jackson Library (1967)

Orangeburg

South Carolina State College Miller F. Whittaker Library (1953)

Rock Hill

Winthrop College Dacus Library (1896)

Spartanburg

Spartanburg County Public Library (1967)

SOUTH DAKOTA

Aberdeen

Northern State College Beulah Williams Library (1963)

Brookings

South Dakota State University H. M. Briggs Library (1889)

Pierre

South Dakota State Library (1973)
South Dakota Supreme Court Library (1978)

Rapid City

Rapid City Public Library (1963)
South Dakota School of Mines and Technology Devereaux Library (1963)

Sioux Falls

Augustana College Mikkelsen Library (1969)
Sioux Falls Public Library (1903)

Spearfish

Black Hills State College Library Learning Center (1942)

Vermillion

University of South Dakota I. D. Weeks Library (1889)

TENNESSEE

Bristol

King College E. W. King Library (1970)

Chattanooga

Chattanooga-Hamilton County Bicentennial Library (1908)
U.S. Tennessee Valley Authority Technical Library (1976)

Clarksville

Austin Peay State University Felix G. Woodward Library (1945)

Cleveland

Cleveland State Community College Library (1973)

Columbia

Columbia State Community College John W. Finney Memorial Library (1973)

Cookeville

Tennessee Technological University Jere Whitson Memorial Library
(1969)

Jackson

Lambuth College Luther L. Gobbel Library (1967)

Jefferson City

Carson-Newman College Library (1964)

Johnson City

East Tennessee State University Sherrod Library (1942)

Knoxville

Knoxville County Public Library System Lawson McGhee Library
(1973)
University of Tennessee at Knoxville James D. Hoskins Library (1907)
University of Tennessee Law Library (1971)

Martin

University of Tennessee at Martin Paul Meek Library (1957)

Memphis

Memphis-Shelby County Public Library and Information Center (1896)
Memphis State University Cecil C. Humphreys School of Law Library
(1979)
Memphis State University Libraries (1966)

Murfreesboro

Middle Tennessee State University Todd Library (1912)

Nashville

Fisk University Library (1965)
Public Library of Nashville and Davidson County (1884)
Tennessee State Law Library (1976)
Tennessee State Library and Archives (unknown)
Tennessee State University Brown-Daniel Library (1972)
Vanderbilt University Alyne Queener Massey Law Library (1976)
Vanderbilt University Library (1884)

Sewanee

University of the South Jessie Ball duPont Library (1873)

TEXAS

Abilene

Abilene Christian University Margaret and Herman Brown Library
(1978)
Hardin-Simmons University Rupert and Pauline Richardson Library
(1940)

Arlington

Arlington Public Library (1970)
University of Texas at Arlington Library (1963)

Austin

Texas State Law Library (1972)
Texas State Library (unknown) REGIONAL
University of Texas at Austin Perry-Castañeda Library (1884)
University of Texas at Austin Edie and Lew Wasserman Public Affairs
Library (1966)
University of Texas at Austin Tarlton Law Library (1965)

Baytown

Lee College Library (1970)

Beaumont

Lamar University Mary and John Gray Library (1957)

Brownwood

Howard Payne University Walker Memorial Library (1964)

Canyon

West Texas State University Cornette Library (1928)

College Station

Texas Agricultural and Mechanical University David G. Evans Library
(1907)

Commerce

East Texas State University James Gilliam Gee Library (1937)

Corpus Christi

Corpus Christi State University Library (1976)

Corsicana

Navarro College Gaston T. Gooch Library (1965)

Dallas

Bishop College Zale Library (1966)
Dallas Baptist University Vance Memorial Library (1967)
Dallas Public Library (1900)
Southern Methodist University Fondren Library (1925)
University of Texas Health Science Center Dallas Library (1975)

Denton

North Texas State University Library (1948)

Edinburg

Pan American University Library (1959)

El Paso

El Paso Public Library (1906)
University of Texas at El Paso Library (1966)

Fort Worth

Fort Worth Public Library (1905)
Texas Christian University Mary Coats Burnett Library (1916)

Galveston

Rosenberg Library (1909)

Houston

Houston Public Library (1884)
North Harris County College Learning Resource Center (1974)
Rice University Fondren Library (1967)
South Texas College of Law Library (1981)
Texas Southern University Thurgood Marshall School of Law Library (1982)
University of Houston-Clear Lake Alfred R. Neumann Library (1980)
University of Houston-University Park Library (1957)
University of Houston School of Law Library (1979)

Huntsville

Sam Houston State University Newton Gresham Library (1949)

Irving

Irving Public Library System (1974)

Kingsville

Texas Arts and Industries University Jernigan Library (1944)

Laredo

Laredo Junior College Harold R. Yeary Library (1970)

Longview

Nicholson Memorial Public Library (1961)

Lubbock

Texas Tech University Library (1935) REGIONAL
Texas Tech University School of Law Library (1978)

Marshall

Wiley College Thomas Winston Cole Sr. Library (1962)

Nacogdoches

Stephen F. Austin State University Steen Library (1965)

Plainview

Wayland Baptist University Van Howeling Memorial Library (1963)

Richardson

University of Texas at Dallas McDermott Library (1972)

San Angelo

Angelo State University Porter Henderson Library (1964)

San Antonio

Saint Mary's University Academic Library (1964)
Saint Mary's University Law Library (1982)
San Antonio College Library (1972)
San Antonio Public Library (1899)
Trinity University Elizabeth Coates Maddux Library (1964)
University of Texas at San Antonio Library (1973)

San Marcos

Southwest Texas State University Library (1955)

Seguin

Texas Lutheran College Blumberg Memorial Library (1970)

Sherman

Austin College Arthur Hopkins Library (1963)

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Texarkana Community College Palmer Memorial Library (1963)

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Victoria College/University of Houston Victoria Campus Library (1973)

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Baylor University Law Library (1982)
Baylor University Moody Memorial Library (1905)

Wichita Falls

Midwestern State University Moffett Library (1963)

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Southern Utah State College Library (1964)

Ephraim

Snow College Lucy A. Phillips Library (1963)

Logan

Utah State University Merrill Library and Learning Resources Center (1907) REGIONAL

Ogden

Weber State College Stewart Library (1962)

Provo

Brigham Young University Harold B. Lee Library (1908)
Brigham Young University Law Library (1972)

Salt Lake City

University of Utah Eccles Health Sciences Library (1970)
University of Utah Law Library (1966)
University of Utah Marriott Library (1893)
Utah State Library (unknown)
Utah State Supreme Court Law Library (1975)

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University of Vermont Bailey/Howe Library (1907)

Castleton

Castleton State College Calvin Coolidge Library (1969)

Johnson

Johnson State College John Dewey Library (1955)

Lyndonville

Lyndon State College Samuel Reed Hall Library (1969)

Middlebury

Middlebury College Egbert Starr Library (1884)

Montpelier

Vermont Department of Libraries (1845)

Northfield

Norwich University Library (1908)

South Royalton

Vermont Law School Library (1978)

VIRGIN ISLANDS

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Florence Williams Public Library (1968)

Saint Thomas

College of the Virgin Islands Ralph M. Paiewonsky Library (1973)
Enid M. Baa Library and Archives (1968)

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Dept. of the Navy Office of Judge Advocate General Law Library (1963)

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Bridgewater College Alexander Mack Memorial Library (1902)

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Chesapeake Public Library (1970)

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Danville Community College Learning Resources Center (1969)

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Emory and Henry College Kelly Library (1884)

Fairfax

George Mason University Fenwick Library (1960)

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Mary Washington College E. Lee Trinkle Library (1940)

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Hampden-Sydney College Eggleston Library (1891)

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Hampton University Huntington Memorial Library (1977)

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Hollins College Fishburn Library (1967)

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Virginia Military Institute Preston Library (1874)
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Roanoke College Library (1886)

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College of William and Mary Marshall-Wythe Law Library (1978)
College of William and Mary Swem Library (1936)

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Clinch Valley College John Cook Wyllie Library (1971)

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Western Washington University Mable Zoe Wilson Library (1963)

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Eastern Washington University JFK Library (1966)

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Spokane Public Library (1910)

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Tacoma Public Library (1894)
University of Puget Sound Collins Memorial Library (1938)
University of Puget Sound School of Law Library (1978)

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Fort Vancouver Regional Library (1962)

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Whitman College Penrose Memorial Library (1890)

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Bluefield State College Hardway Library (1972)

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West Virginia Library Commission (1975)
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Fairmont State College Library (1884)

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Glenville State College Robert F. Kidd Library (1966)

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Beloit College Col. Robert H. Morse Library (1888)

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Fond du Lac Public Library (1966)

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University of Wisconsin-Green Bay Library Learning Center (1968)

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La Crosse Public Library (1883)
University of Wisconsin-La Crosse Murphy Library (1965)

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Madison Public Library (1965)
State Historical Society of Wisconsin Library (1870) REGIONAL
University of Wisconsin-Madison Memorial Library (1939)
University of Wisconsin-Madison Law Library (1981)
Wisconsin State Law Library (unknown)

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Alverno College Library/Media Center (1971)
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Natrona County Public Library (1929)

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University of Wyoming Law Library (1978)

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